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CONTENTS

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ADDRESS OF THE PRESIDENT TO THE ANTHROPOLOGICAL SECTION OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE[1]

A STUDY OF PRIMITIVE CHARACTER

CIVILIZATION and "savagery"—for unfortunately it seems now too late to substitute any term of less misleading suggestion for that word "savagery"—are the labels which we civilized folk apply respectively to two forms of human culture apparently so unlike that it is hard to conceive that they had a common origin—our own culture and that other, the most primitive form of human culture, from which, at some unknown and distant period, our own diverged. But, assuming one common origin for the whole human race, we anthropologists can but assume that at an early stage in the history of that race some new idea was implanted in a part of these folk, that is in the ancestors of civilized folk which caused these thenceforth to advance continuously, doubtless by many again subsequently diverging and often intercrossing roads, some doubtless more rapidly than others, but all mainly towards that which is called civilization, while those others, those whom we call "savages," were left behind at that first parting of the ways, to stumble blindly, advancing indeed after a fashion of their own, but comparatively slowly and in a quite different direction.

It is easy enough for civilized folk, when after age-long separation they again come across the "savages," to discern the existence of wide differences between the two, in physical and mental characteristics, and

[1] Australia, 1914.

in arts and crafts; it is not so easy, it may even be that it is impossible, to detect the exact nature of these differences, especially in the matter of mental characters.

As a rule the occupant of this presidential chair is one who, whether he has seen much of "savages" at close quarters or not, has had much ampler opportunity than has fallen to my lot of comparative study of that great mass of anthropological observations which, gathered from almost every part of the world, has now been recorded at headquarters. I, on the other hand, happen to have spent the better part of my active life in two different parts of the world, remote from books and men of science, but in both of which folk of civilized and of savage culture have been more or less intermixed, but as yet very imperfectly combined, and in both of which I have been brought into rather unusually close and sympathetic contact with folk who, whatever veneer of civilization may have been put upon them, are in the thoughts which lie at the back of their minds and in character still almost as when their ancestors were at the stage of savage culture.

While trying to adjust the mutual relations of wild folk and of folk of civilized stock, I have seen from close at hand the clash which is inevitable when the two meet —a clash which is naturally all the greater when the meeting is sudden. Moreover, having started with a strong taste for natural history, and especially for the natural history of man, and having had much guidance from many anthropological friends and from books, I have perhaps been especially fortunate in opportunity for studying the more natural human animal at close quarters and in his natural surroundings. I have tried, from as abstract and unprejudiced a point of view as possible, to understand the character, the mental and moral attitude, of the natural "savage" as he must have been when civilized folk first found him and, at first without much effort to understand him, tried abruptly to impose an extremely different and alien form of culture on this almost new kind of man.

I venture to claim, though with diffidence, that I may have begun to discern more clearly, even though only a little more clearly than usual, what the primitive man, the natural "savage"—or, as he might more accurately be described, the wild man —was like; and it seemed possible that an attempt to bring together a picture—it can hardly be more than a sketch—of the mentality and character of some one group of people who had never passed out of the stage of "savagery" might be interesting and practically useful, especially if it proves possible to disentangle the more primitive ideas of such people from those which they subsequently absorbed by contact, at first with other wild, but less wild, folk, and later with civilized folk; and that a further study of the retention by these folk of some of their earlier habits of thought during later stages in their mental development might suggest a probable explanation of certain of their manners and customs for which it is otherwise hard to account.

The attainment of some such understanding is, or should be, one of the chief objectives of the practical anthropologist, not merely for academic purposes, but also for the practical guidance of those who in so many parts of our Empire are brought into daily contact with so-called "savages."

Perhaps hardly anywhere else in the world would it be possible to find better opportunity and more suitable conditions for such a study as I now propose than in the tropical islands of the South Seas. The ancestors of these islanders, while still in

purely "savage" condition, must have drifted away from the rest of the human race, and entered into the utter seclusion of that largest of oceans, the Pacific, covering as it does more than a third of the surface of the globe, long before the first man of civilized race, Balboa, in 1513, from the Peak in Darien, set eyes on the edge of what he called "the Great South Sea," before Magellan, in 1520, forced his way into and across that same sea, which he called the Pacific, and certainly long before civilized men settled on any part of the shore of that ocean, *i. e.*, in 1788, at the foundation of Australia. For when first studied at close quarters by civilized folk from Europe, which was not till after the last-named event, these South Sea "savages" had been in seclusion during a period sufficiently long—and certainly no short period would have sufficed for such an effect—not only for them all to have assumed characters, cultural and even physical, sufficient to distinguish them from all other folk outside the Pacific, but also for them to have split up into many separate parties, probably sometimes of but few individuals, many of which had drifted to some isolated island or island-group, and had there in the course of time taken on further well-marked secondary differences.

It will probably now never be discovered when, how often, and from what different places the ancestors of these folk reached the Pacific. It is quite possible that they entered again and again, and were carried by winds and currents, some from west to east and some in the reverse direction, many perishing in that waste of waters, but some reaching land and finding shelter on some of that great cloud of small islands which lie scattered on both sides of the equator and nearly across that otherwise landless ocean.

Of the folk who in those old times thus drifted about and across the Pacific, the most important, for the part which they played in the story which I am endeavoring to tell, were the two hordes of "savages" now known respectively as Melanesians and Polynesians. Without entering deeply into the difficult subject of the earlier migrations of these two hordes, it will suffice here to note that, towards the end of the eighteenth century, when European folk at last began to frequent the South Sea Islands, and when consequently something definite began to be known in Europe about the islanders, certain Melanesians, who had probably long previously drifted down from north-westward, were found to be, and probably had long been, in occupation of the exceptionally remote and isolated Fiji Islands; also that, long after this Melanesian occupation of these islands, and only shortly before Europeans began to frequent them, several bodies of Polynesians, who had long been in occupation of the Friendly or Tongan Islands, lying away to the east of Fiji, had already forced or were forcing their way into the Fijian Islands.

The meeting in Fiji of these two folk, both still in a state of "savagery," but the Polynesians much further advanced in culture than the Melanesians, at a time before European influence had begun to strengthen in those islands, affords an exceptionally good opportunity for the study of successive stages in the development of primitive character, especially as the two sets of "savages" were not yet so closely intermingled as to be indistinguishable—at least in many parts of Fiji. It is unfortunate that the earliest European visitors to Fiji were not of the kind to observe and to leave proper records of their observations.

The earlier, Melanesian, occupants of Fiji had to some extent given way, but by no means readily and completely, to the

Polynesian invaders. The former, not only in the mountain fastnesses difficult of access, but also in such of the islets as the local wind and weather conditions made difficult of access, retained their own distinct and simpler culture, their own thoughts, habits and arts, long after the Polynesians had seized the more important places accessible to the sea, and had imposed much of their own more elaborate (but still "savage") culture on such of the Melanesians' communities as they had there subjugated and absorbed.

The social organization throughout Fiji remained communistic; but in the purely Melanesian communities the system was purely democratic (*i. e.*, without chiefs), while in the newer mixed Polynesian-Melanesian communities—as was natural when there had been intermingling of two unequally cultured races—there had been developed a sort of oligarchic system, in which the Melanesian commoners worked contentedly, or at least with characteristic resignation, for their new Polynesian chiefs.

Alike in all these communities custom enforced by club-law prevailed; but in the one case the administrative function rested with the community as a whole, while in the other it was usurped by the chiefs.

Though we are here to consider mainly the ideas, the mentality, of these people, it will be useful to say a few preliminary words as to their arts and crafts. The Melanesians during their long undisturbed occupation of the islands had undoubtedly made great progress, on lines peculiar to them, especially in boat building, in which they excelled all other South Sea islanders, in the making of clubs and other weapons, and in otherwise using the timber, which grew more abundantly, and of better quality, in their islands than elsewhere. Meanwhile the Polynesians, in their earlier homes and long before they reached Fiji, had developed, in very high degree, corresponding but different and much more elaborate arts (and ideas) of their own. But, as we know from Captain Cook, the Polynesians, despite their own higher culture, from their Tongan homes, greatly admired and appreciated the special craftsmanship of the Fijians, and it was indeed this admiration which attracted the former from Tonga to Fiji; and when the Polynesians had gained footing in the Fijis they—quite in accordance with human nature—were inclined, for a time at least, to foster the foreign Fijian arts—if not Fijian ideas—rather than replace these by their own arts; and before the struggle, both physical and cultural, between the two sets of "savages" had gone far it was interrupted, and more or less definitely arrested, by the arrival and gradual settlement of the still more powerful, because civilized, white folk from the western world.

In turning to the earlier (Melanesian) occupants of Fiji, and especially to the less advanced of these, to find the traces of which we are in search of the more primitive habit of thought, it must not be forgotten that even at the stage at which we begin to know about them they had made considerable advance, in their ideas as well as in their arts and crafts. They still used their most primitive form of club, but also made others of much more elaborated form; so, though the ideas which lay at the basis of their habit of thought were of very primitive kind, they had acquired others of more complex character.

Before going further may I say—and I sincerely hope that the suggestion will not be misunderstood—that in the difficult task of forming a clear conception of the fundamental stock of thought which must have guided the conduct of the more primitive folk we must constantly bear in mind the parallelism (I do not mean necessary iden-

tity of origin) between the thoughts of the earliest human folk and the corresponding instincts (as these are called) noticeable in the case of some of the higher animals? I am particularly anxious not to be misunderstood; the suggestion is not that even the most primitive human folk were mentally merely on a par even with the higher animals, but that many, perhaps most, of the ways of thought that guided the primitive man in his bearing towards the world outside himself may be more easily understood if it is once realized, and afterwards remembered, that the two mental habits, however different in origin and in degree of development, were remarkably analogous in kind.

A similar analogy, in respect not of thoughts but of arts, may well illustrate this correspondence between the elementary ideas of men and animals. The higher apes occasionally arm themselves by tearing a young tree up by the roots and using the "club" thus provided as a weapon of offense and defense against their enemies. Some of the primitive South Sea islanders did—nay, do—exactly the same, or at any rate did so till very lately. The club—the so-called *malumu*—which the Fijian, then and up to the much later time when he ceased to use a club at all greatly preferred to use for all serious fighting purposes was provided in exactly the same way. *i. e.*, by dragging a young tree from the ground, and smoothing off the more rugged roots to form what the American might call the business end of the club. But though the Fijian, throughout the period during which he retained his own ways, used and even preferred this earliest form of club, he meanwhile employed his leisure (which was abundant), his fancy, and his ingenuity, in ornamenting this weapon, and also in gradually adapting it to more and more special purposes, some of the later of which were not even warlike but were ceremonial purposes, till in course of time each isolated island or group of islands evolved clubs special to it in form, purpose and ornament, and the very numerous and puzzlingly varied series of elaborate and beautiful clubs and club-shaped implements resulted. It seems to be in power of improvement and elaboration that lies the difference between men-folk and animal-folk.

Something similar may be assumed to have brought about the evolution of the ideas of these islanders. Starting with a stock of thoughts similar in kind to the instincts of the more advanced animals, the human-folk—by virtue of some mysterious potentiality—gradually adapted these to meet the special circumstances of their own surroundings, and in so doing ornamenting these primitive thoughts further in accordance with fancy.

In the Fiji Islands this process of cultural development was probably slow during the long period while the Melanesians, with perhaps the occasional stimulus afforded by the drifting in of a little human flotsam and jetsam from other still more primitive folk, were in sole occupation; yet it must have been during this period and by these folk that the distinctively Fijian form of culture was evolved. But the process must have been greatly accelerated, and at the same time more or less changed in direction, by the incoming of the distinct and higher Polynesian culture, at a time certainly before, but perhaps not very long before, the encroachment of Europeans.

In order to realize as vividly as possible what were the earlier, most elementary, thoughts on which the whole detail of his subsequent "savage" mentality was gradually imposed, it is essential for the time being to discard practically all the ideas

which, since the road to civilization parted from that on which savagery was left to linger, have built up the mentality of civilized folk; it is essential to try to see as the most primitive Fijian saw and to conceive what these islanders thought as to themselves and as to the world in which they found themselves.

It seems safe to assume that the primitive man, absolutely self-centered, had hardly begun to puzzle out any explanation even of his own nature, still less of the real nature of all the other beings of which he must have been vaguely conscious in the world outside himself. To put it bluntly, he took things very much as they came, and had hardly begun to ask questions.

He was—he could not but be, as the lower animals are—in some vague way conscious of himself, and from that one entirely self-centered position he could not but perceive from time to time that other beings, more or less like himself, were about him, and came more or less in contact with him.

The place in which he was conscious of being appeared to him limitless. He did not realize that he could move about only in the islet which was his home, or perhaps even only in a part of a somewhat larger, but according to our ideas still small, island; if other islets were in sight from that on which he lived, these also would be part of his world, especially if—though such incidents must have been rare—he had crossed to, or been visited by strangers from, those islands—islands which lay between his own home and that which he spoke of as *wai-langi-lala* (water-sky-emptiness) and we speak of as the horizon. To him the world was not limited by any line, even the furthest which his sight disclosed to him. Rarely, but still sometimes, strangers had come from beyond that line. Perhaps too he had some time heard that his ancestors had come from the somewhere which seemed beyond. Again his ancestors of whom he had heard, and even some of the contemporaries whom he had seen, though no longer with him except occasionally during his dreams in bodily form, were somewhere, somewhere beyond that line of sight. Even he himself (in what were his dreams, as we say, but to him were part of his real life) habitually went beyond the line, and, as far as his experience had gone, returned each time to the island home.

Moreover, he did not doubt that this limitless region in which it vaguely seemed to him that he, and innumerable other beings, moved, extended not merely along what we speak of as the surface of the globe, but also, and equally without any intervening obstacle, up into the infinite space above and beyond the sky. In short, to this primitive man the world, though the part of it to which he had actual access was so small, was limitless.

The thoughts of the dweller in this vague world, as to himself and as to the other beings of which from time to time he became conscious, must have been correspondingly indefinite.

He was, to a degree almost if not quite beyond our power of conception, a spiritualist rather than a materialist; and it is essential to get some idea of the extent and manner of his recognition of spiritual beings—and his corresponding non-recognition of things material.

In passing I here disclaim, for myself at least, the use of the misleading word "belief" in speaking of the ideas of really primitive man—as, for instance, in the phrase the "belief in immortality." Possibly primitive men of somewhat more advanced thought, though not yet beyond the stage of "savagery," may have "believed" in spirits, in immortality, and so on; but it

seems to me that at the earlier stage there can hardly have been more than recognition (admittedly very strong recognition) of spiritual beings, and non-recognition of any beginning or ending of these spirits.

To return from this digression, Sir E. B. Tylor long since gave currency to the very useful word "animism" as meaning "the belief in spiritual beings," and this has been taken to mean that animism was the initial stage, or at any rate the earliest discoverable stage, of all religion. The primitive Fijian was certainly a thorough-going animist, if his extraordinarily strong but vague recognition of spiritual beings suffices to make him that; but I do not think that the ideas of that kind of the primitive "savage"—or, say, of the most primitive Fijian—before his ideas had been worked up into somewhat higher thought, during the long period while he was secluded in his remote islands and before the advent of the Polynesians, had developed far enough to constitute anything which could be called "religion," though doubtless they were the sort of stuff which, had these folk been left to themselves, might, probably did, form the basis of the "religion" towards which they were tending.

Practically all human beings—savage and civilized alike—and, though in lower degree, even animal-folk, have in some degree recognized the existence of some sort of spiritual beings. The point then seems to be to discover what was the nature of the spiritual beings which the primitive Fijian recognized but without understanding.

Anthropologists have recently defined, or at least described, several kinds of spiritual beings as recognized (even here I will not use the word "believed") by more or less primitive folk. There is, first, the soul, or the separable personality of the living man or other being; secondly, the ghost, or the same thing after death; thirdly, the spirit, which is said to be a soul-like being which has never been associated with a human or animal body; and, fourthly, there is, it appears, to be taken into consideration yet another kind of spiritual being (or something of that nature) which is the life of personality, not amounting to a separable or apparitional soul, which, it has been supposed, some primitive folk have attributed to what we call "inanimate things."

It seems, though I say this with all due deference, that this identification and naming of various kinds of spiritual beings, though it may hold good of animism at a higher stage, does not fit the case of the more primitive animist (say, that of the Melanesian in the very backward state in which, as far as we know, he first reached Fiji), for presumably he had not as yet recognized nor differentiated between the various kinds just enumerated. He recognized something which may be called the "soul," which was the separable personality of the living man or other being. But he did not recognize—perhaps it would be better to say that he had not yet attained to recognition of—the ghost, or the same thing after death; for he had not even recognized any real break, involving change, at death. Nor, as I think, did he recognize a spirit, *i. e.*, a soul-like being which had never been associated with a human or animal body; for he had no idea of any spiritual being which did not, or could not, on occasion associate itself with a human, animal or other material body, nor seemingly had he reached the stage, labelled *animatism*, in which he would have attributed life and personality to things (which I take to mean things which are to us inanimate).

All that the most primitive man would recognize would be that he himself—the essential part of him—was a being (for

convenience and for want of a better name it may be called "soul") temporarily separable at any time from the material body in which it happened to be, and untrammeled—except to some extent by the clog of the body—by any such conditions as time and space; he had found no reason to think that in these respects the many other beings of which from time to time he became aware (whether these were what we should class as men, other animals, or the things which we speak of as inanimate, such as stocks and stones, or bodiless natural phenomena, such as winds) differed from himself only in the comparatively unimportant matter of bodily form; moreover, it seemed to him that, as he himself could to some extent do all these, the other beings, and some perhaps even more easily, were able to pass from one body to another.

He felt that these "souls" were only temporarily and more or less loosely attached to the particular material forms in which they happened to manifest themselves at any moment, and that the material form in which the soul (and noticeably this held good even of his own soul) happened at any moment to be embodied was of little or no real importance to that soul, which could continue to exist just as well without as with that body.

Another point which it is important to note is the egoism of the savage man as distinguished from the altruism of the civilized man; for it was perhaps the beginning of the idea of altruism, of duty to one's neighbor, that gave the start to civilization, and it was because the ancestors of the savage had never got hold of this fundamental principle of altruism that they were left behind.

The uncivilized man, complete egoist as he was, thought and acted only for his own personal interests. It is true that he was to a certain extent kind (as we might call it) to the people of his own small community and possibly still more kind to such of the community as seemed to him more immediately of his own kindred. But this kindness was little more than instinctive—little more than a way of attracting further service. It is also true that on the occasions, which must have been very rare till a late period in the Melanesian occupation of Fiji, when strangers —*i. e.*, persons of whom he had not even dreamed—came, so surprisingly, into his purview, he was sometimes civil or even hospitable to those strangers (it should not be forgotten that to him these were souls embodied by separable accident in material forms); but this would have been only on occasions on which he knew, or suspected, that these visitors were stronger than himself and able to injure or benefit him.

Another point of great significance in the character of this primitive man was that he had no conception of ownership of property. To him all that we should class as goods and chattels, his land, or even his own body, was his only so long as he could retain it. He might if he could and would take any such property from another entirely without impropriety; nor would he resist, or even wish to resist, the taking from himself of any such property by any one who could and would take it.

Again, the primitive man must have been far less sensitive to pain, and far less subject to fear, than the normal civilized man. I do not mean that the primitive Fijian was without the ordinary animal shrinking from physical pain, but that he can not have been nearly as sensitive even to physical pain as is the more sophisticated man; nor had he the same mental pain, the same anticipation and fear of pain, that the civilized man has.

Having thus dealt with some of the more important points in the character of the primitive Fijian, I propose next to consider how far these suffice to account for some of the more "savage" conditions under which these islanders when first seen were living.

Cannibalism claims the first mention, in that, though the practice has been recorded from many other parts of the world, it is commonly supposed to have been carried further in Fiji than elsewhere.

Here, however, it is at once necessary to point out that the outbreak of cannibalism in Fiji in the first half of the last century was not due to any innate and depraved taste on the part of the Fijians, and that the practise to the degree and after the fashion of which the story-books tell was not natural to the Fijian, whether of Melanesian or Polynesian stock.

It is probable, even perhaps certain, that all the Fiji islanders occasionally ate human flesh before the coming of white men to the islands; but it was only after the arrival of the new-comers that this practise, formerly only occasional and hardly more than ceremonial, developed into the abominable orgies of the first half of the last century. The first Europeans to set foot—about 1800—and to remain in the islands for any time were the so-called "beachcombers." At first at least, these renegades from civilization, to secure their own precarious position and safety, contrived to put themselves under the patronage of some one or other of the great native chiefs, who would be Polynesians, and assisted and egged on these chiefs in their then main occupation of fighting other great rival chiefs, also Polynesians, and raiding the less advanced Melanesians of the surrounding districts. The guns and ammunition which the beachcombers, in some cases at least, brought with them or managed to procure, and the superior craft which they had imbibed from civilization, greatly assisted them in this immoral purpose. Consequently a habit of cruelty, new to the Fijian, was implanted and developed, especially in the Polynesian chiefs. It became more and more a fashion for the greatest native warriors, thus egged on, to vie with each other in the number of their victims and in the reckless cruelty with which these were killed. Doubtless at first the victims were opponents killed in fight, sometimes great rival chiefs and sometimes mere *hoi polloi* who had been led out to fight, probably not very reluctantly, for their chiefs. Incidentally more and more people were killed; and the bodies of the slain were conveniently disposed of in the ovens. A taste for this food was thus developed in the chiefs—though this seems, for a time at least, to have been confined to the great chiefs, most of those of lower status, and all women, refusing to partake, at any rate till a later period. Before long, when the number of the killed ran short, the deficiency was made up by clubbing more and more even of their own people, till eventually the great native warrior took pride in the mere number of those he had killed and eaten.

It seems probable that even the coming of the missionaries, who first reached Fiji thirty or forty years after the earliest beachcombers, and at once began almost heroic efforts to stop cannibalism, thereby to some extent temporarily even aggravated the evil. For the chiefs, in their characteristic temper of gasconade, killed and ate more and more unrestrainedly, in mockery of the missionaries and to show what fine fellows they thought themselves to be.

To return from this digression into a somewhat distasteful subject, cannibalism as practised by the Fijians before the com-

ing of white men was very different, and, from the Fijian point of view—if I may say so without fear of being misunderstood—not altogether indefensible. It must be remembered that there was, as it were, no killing in our sense of the word involved, merely a setting free from the non-essential body of the essential soul, which soul survived just as well without the body as with it.

Note that the soul must have been considered as in some way and for a time still associated with its late body if, as is commonly and perhaps rightly held, the slayer sometimes ate some part of the body of the slain in order to acquire some of the qualities of the slain.

Again, there can be little doubt that men were sometimes killed for sacrificial purposes, the material bodies of the victims being placed at some spot (perhaps the tomb) considered to be frequented by the disembodied spirit of some ancestor for whom it was desired to provide a spirit attendant. It may be noted that this sacrificial use of the body might be combined with an eating of the same body when once it had served its first purpose of attributing the spirit which had been in it to the service of the honored ancestor.

It has been laid to the charge of the Fijians (as to that of many other folk of savage and even of civilized culture) that they habitually killed strangers, especially such as had been washed or drifted to the islands by the sea—who, in early times at least, must have been almost the only strangers to arrive. The charge, like that of cannibalism, has been exaggerated, and the facts—as far as there were any—on which this charge was founded have been misunderstood.

Here, again, the attitude of the Fijian in this respect was hardly different from that of the lower animals under similar circumstances. The Fijian knew of no reason to be glad of the arrival of strangers, unless these could, in one way or another, be useful to him; and, as has already been explained, he knew of no reason why he should not make the best use possible of the stranger, of his body or his spirit, separately or together.

While, as must have been the case in earlier times, the new-comers were dark-skinned men like himself, the Fijian might without the slightest prick of conscience separate their bodies from their spirits, and dispose of the body or the spirit separately; or without effecting this separation, he might simply enslave the new-comers; or, again, if he suspected that the new-comers were too strong for him, he might yield himself to them as a slave.

And later, when Europeans began to arrive, sometimes as refugees from passing ships and sometimes as survivors from ships wrecked on the surrounding reefs, the bearing of the Fijian towards this new kind of stranger would have been on the same principles, only that in this case the new-comers, being of far less readily understood kind, would be regarded with more suspicion and also more respect. I believe that very seldom, if ever, was an inoffensive white man, wrecked sailor or other, killed, or treated with anything but kindliness and courtesy, even though the wrecked man's property might naturally be appropriated by the natives. It was only when white-skinned strangers became commoner, and frequently more offensive, and when familiarity had bred contempt, that they were killed, as nuisances, and, especially during the great outbreak of cannibalism, were eaten.

This point in the bearing of the islanders to white men might be further illustrated by a circumstance which, to my surprise, I have never found mentioned, *i. e.*, that

during the whole period while the missionaries were, with a rashness only justified by the circumstances, testifying against the natives of Fiji not one of these was killed, till at a much later period, when European influence was all but predominant in Fiji, Baker was killed and eaten under very special circumstances.

If it were possible to ascertain in each case the facts as to the reception by "savages" of the first white men they saw, it would almost certainly be found that the reception was apparently kindly, though this kindness may really have been due to fear and not to charity. It was, however, quite probable that at any moment the savage might find that his dread of the white man was unfounded, and in that case he might kill him (*i. e.*, separate his soul from his body) without hesitation, and after doing this his fear—he probably never had any affection for him—of the disembodied spirit of the white man might be as great, or even greater, than before.

Incidentally it may here be noted, as a further curious point, that a Fijian who thus quite remorselessly set free the soul of a stranger from his body would probably not often and not for long in his dreams be revisited by his victim, if a native; and perhaps not even if the victim were a white man, unless very remarkable. In other words, the victim survives only just so long as he is remembered. Captain Cook, we know, survived for very long, perhaps does so still; few, if any, of such beachcombers as were later killed in Fiji survived for any length of time; and the innumerable natives who were drifted or washed to one or other of the islands must for the most part have passed from memory soon after they were killed.

It has been suggested that the killing of strangers may have been for the purpose of preventing the introduction of disease; and it is certain that, perhaps even before the coming of white men, the islanders recognized that the advent of strangers was curiously often and most disastrously followed by the introduction of new diseases, either real diseases or at least some queer, unexplained influence which has so often made life not worth living for savages where white strangers have been.

The Fijians were hardly more notorious for cannibalism than for theft—and almost as undeservedly. There is hardly an account of the visit of a European ship in early times to any of the islands which does not mention that the islanders who came aboard took whatever they fancied, either quite openly or if furtively then without evincing anything like shame when discovered. This habit, which the explorers naturally called theft, was but the manifestation of a South Sea custom, due to the entire absence of any idea of personal property, which in Fiji is called keri-keri. To keri-keri was to take whatever you wanted and could take without the previous holder of the property preventing you. In old days no Fijian doubted his own absolute right to keri-keri, nor did he feel the very slightest shame in thus (as we should say) "depriving another of his property" or "stealing"; and even to this day the Fijian, provided that he is not really Europeanized, will keri-keri without shame. In short the idea of ownership and individual property never occurred to the natural Fijian. He took what he wanted, and was strong enough to take. But, on the other hand, he yielded up, practically without reluctance, whatever another stronger or cleverer than himself wanted and was able to take from him.

Of the many other charges of "savagery" made against Fijians, I can, in the time at my disposal, deal with but one

more, that as to their strange and gruesome habit of celebrating great occasions by killing their own folk. When a Fijian chief died, as we should say, or, as it seemed to the surviving natives when his soul left the body which it had for a time used, his widows, and other of his kindred and dependents, unwilling to be left behind, were strangled, often indeed helped to strangle themselves, that their bodies might be put into the graves, while their souls went gladly with that of the chief whom they had been accustomed to follow.

Again, when a chief built a house, some of his dependents, whom the great man told off for the purpose, willingly stepped down into the holes which had been dug for the house-posts, and remained there while the earth was filled in on to them, and continued thereafter as permanent supporters of the house.

Again, there is a tradition, which at least was not incredible to the natives, that a great chief one day went a-fishing, and caught many fish. Two brothers of humbler rank who happened to have come down to the same waterside, also to fish, were less successful. The chief, in a characteristic freak of generosity, presented his best fish to the elder of the two brothers, who, strictly according to Fijian custom, accepted the gift, but felt bound to make an immediate return, but he had nothing to give. Thereupon the younger brother, at his own suggestion, was clubbed by the elder, and his body presented to the chief in token that his soul would thereafter serve that chief.

It is even said that when yams and other vegetables were brought in as food for the chiefs by the dependents who had grown them for that purpose, the food-bearers, if there was a scarcity of fish or other suitable accompaniment for the vegetable diet, were themselves clubbed and their bodies eaten. This particular atrocity probably happened only after the habit of cannibalism had, as already explained, been unnaturally intensified. But the story is noteworthy in that the food-bearers are not represented as in any way dreading or shirking the use to which their bodies were put.

In all these and similar cases it is to be noted that the victims (as we are naturally inclined to call them) were more or less indifferent, if indeed they were not eagerly consenting parties, to the use (cruel as it seems to us) made of their material bodies. Thus the widows were eager to be strangled, and often even helped to do the deed, in order that they—all that was essential of them, *i. e.*, their souls—should rejoin the deceased. Similarly those others who were killed on the occasion of the funeral were quite willing to give their bodies, which seemed of comparatively little importance, as "grass" to be added to the cut fern and other soft material on which the body of the deceased chief was couched in the grave; and quite willingly the men told off for that purpose stepped down into the holes in which the house-posts were grounded, that they, or rather their bodies, might thereafter hold up the house, while their souls enjoyed life much as before but without the encumbrance of the body. Others again contentedly grew *taro* for the chiefs to eat, and carried it in when ripe, thinking it of little importance that their mere bodies might be eaten with the *taro*.

In conclusion, having endeavored to realize for myself, and to show you a glimpse, of the enormous, hardly conceivable difference in habit of thought, and consequently in character, which separates the savage from the civilized man, I will offer a suggestion which seems to me possibly the most important outcome of my personal experience, now closed, as an anthropolog-

ical administrator in tropical places where Eastern and Western folk have met, and where the inevitable clash between the two has occurred.

In such places and circumstances the result has too often been that sooner or later the weaker folk—those whose ancestors have been age-long "savages"—have died out in the presence of those whose ancestors long ago turned from "savagery" to civilization. This dying out of the weaker folk has happened even when the stronger people have done their best to avoid this extirpation.

The real ultimate cause of "the decrease of natives" when in contact with civilized folk lies, perhaps, in the difference in hereditary mentality—in the incapacity of the "savage" to take on civilization quickly enough. However sedulously the missionary, the government official, and others who take a real interest in so doing, may teach civilized precepts to the essential savage, the subject of this sedulous case—however advanced a savage culture he may have attained—will, at least for many generations, remain a savage, *i. e.*, for just so long as he is under influence of the civilized teacher he may act on the utterly strange precepts taught him, but away from that influence he will act on his own hereditary instincts.

The manner in which the native dies out—even when well looked after—varies. He may be killed out by some disease, perhaps trifling but new to him, with which he does not know how to cope, and with which—if he can avoid so doing—he simply will not cope in the ways which the civilized man would teach him; or he may be killed out by the well-meant but injudicious enforcement on him of some system of unaccustomed labor; or, again, he may die out because deprived of his former occupations [*e. g.*, fighting and the gathering of just so much food as sufficed for him] and thus restricted to a merely vegetative existence; or in many other more or less similar forms his extermination may come about.

But all such effective causes are reducible to one, which is that he is not allowed to act on his own hereditary instincts, that he can not at all times have, and often would not use, judicious and disinterested guidance from civilized folk, and that consequently he, the "savage," can not and too often does not care to keep alive when in the presence of civilized folk.

EVERARD IM THURN

GEORGE MARCGRAVE, A POSTSCRIPT

IN the *Popular Science Monthly* for September, 1912, I published a biographical sketch of "George Marcgrave, the First Student of American Natural History." A copy of this paper was sent to Dr. Alfredo de Carvalho, Pernambuco, Brazil, president of the Instituto Archeologico e Geographico of that city, and a profound student of the history of his country and especially of that period during which the Dutch occupied Pernambuco and the adjacent parts of Brazil. He wrote me of his study of Marcgrave, who did his natural history work at and around Pernambuco, or Recife as it is called by the Brazilians, and sent me a copy of his article—"Um Naturalista do Seculo XVII, Georg Markgraf, 1610–1644"—in *Revista do Instituto Archeologico e Geographico Pernambucano,* Vol. XIII., pp. 212–22, 1908. I greatly regret that this paper was not included in my bibliography of George Marcgrave.

In speaking of Marcgrave's death it was stated in my sketch that this occurred on the Gold Coast of Africa, by which term was meant all that pestilential region around the Gulf of Guinea. However, the Gold Coast proper is a section of the coast lying west of the Bight of Benin, and there is good reason to believe that Marcgrave died in Angola at or near San Paulo de Loanda, some distance south of the mouth of the Congo.

In my paper all the intimate and personal

data concerning Marcgrave's boyhood, his 11 years of preparation for his life work, and his 6½ years of exploration and study in Brazil, were taken directly from a sketch found in Manget's "Bibliotheca Scriptorum Medicorum" (1731), and from authors who had gotten their data from this article. At the time the paper above referred to was written I had not had an opportunity of examining Manget's huge folio, and as the three gentlemen who had looked it over for me found nothing to indicate who was the author of the sketch of Marcgrave therein contained, I was at first inclined to think Manget himself the writer. However, the sketch was written in the first person by a man who personally knew Marcgrave, Count Moritz, Piso, and all the other principals in the Dutch expedition to Brazil of 1637–38, and as Manget was not born until some years after Marcgrave's death, I had to content myself with referring to "the unknown writer in Manget."

During the Christmas holidays, 1912, while at work in the libraries at Washington, I went to the Surgeon General's Library and personally looked over the sketch of George Marcgrave contained on pages 262–264 of Manget's volume II., but found absolutely nothing to indicate who was the writer. However, on the adjoining pages were a number of short sketches of various Marggrafs (the German spelling of the name), all of which were worked over. Presently I came to Christian Marggraf (1612–1687) who, it was stated, published "Prodromus Medicinæ Practicæ" in 1674, "Materia Medica Contracta" in 1674, and in 1715 "Opera Medica Duobus Libris Comprehensa." Following the last title came this highly interesting statement:

> In hac libro anteponitur vita fratris ejus natu majoris Georgii Marcgravii quam infra subjectam videas. (In this book there is placed at the front the life of his older brother, George Marcgrave, which you may see appended below.)

Search was immediately made through the catalog of the Surgeon General's Library, and the Prodromus and the Materia Medica were both found, but the Opera Medica was lacking. This search was extended to a number of the large libraries throughout the east, but none of them contained the Opera. However, Mr. Charles Perry Fisher, Librarian of the College of Physicians, Philadelphia, kindly informed me that the "Opera Medica" simply consists of the "Prodromus" and the "Materia Medica" united and republished under the new title "Opera Medica" in 1715. Since the book could not be found in America, an effort was made to locate it in Europe, and a copy in perfect condition was reported in the Library of the Faculty of Medicine in Paris. This book was wanted that it might be ascertained whether Manget had published everything that Christian Marggraf had written about his brother George. About this time a letter was received from Dr. Perlbach of the Royal Library of Berlin, which effectually cleared up the whole matter. (I had previously written Dr. Perlbach, who had supplied me with much valuable data for the original paper on George Marcgrave.)

He stated that the Royal Library of Berlin does not contain "Christian Marggravius: Opera Medica Duobus Libris Comprehensa, Amstelodami apud Franciscum van der Plaats, 1715, 4°"; but that it does have his "Prodromus Medicinæ Practicæ, Lugduni Batavorum, ex officium Arnoldi Doude, 1673, and 1674, 4°" (it seems probable that the printing began late in 1673 and ran over into the next year); also it has the same "Editio 2 auctior Lugduni Batavorum apud Cornelium Bontestyn, 1685, 4°." Further the Royal Library also has "Materia Medica Contracta, Lugduni Batavorum apud Arnoldum Doude 1674, 4°," and the same "Editio 2 aucta Amstelodami apud Henricum Wetstenium 1682, 4°."

Touching the matter particularly in hand, Dr. Perlbach then concluded:

> In the second edition of the Prodromus (1685) there are found (following the preface [dated at] Lugduni Batavorum, Calendis Februarii, 1685), four unpaged leaves containing the life of George Marcgrave, which Manget, Bibliotheca Scriptorum Medicorum II., pp. 262–64, prints word for word with the edition of the author. I have compared the two texts, and with the exception of some

typographical errors and a line omitted by Manget they agree word for word.

The line referred to merely tells us that Count Moritz had added Marcgrave to his expedition as his friend and associate.

There is internal evidence in the sketch in Manget which now clearly corroborates the above, for in the last paragraph the writer refers to "this man of most delightful memory standing to me as an older brother." Now also is made clear the dislike, amounting almost to hatred, of this writer for Piso, who is charged with doing everything in his power to enhance his reputation at the expense of Marcgrave's, calling Marcgrave "my domestic," minimizing his importance as a member of the expedition, his work as a collector and observer of natural objects, and his standing as a scientific man.

Exceedingly unfortunate is it that Christian was never able to carry out his purpose expressed in these words:

> His [George's] Brazilian itinerary, if God will so permit, I shall publish, because it contains an exact description of his voyage to Brazil, together with notes on winds, rains and calms. It will not lack accounts of fishing and hunting with the barbarians, and geographical descriptions and notices of places.

By this is probably meant a publication of George Marcgrave's journals, of which notice is made in the body of Christian's sketch and concerning which all the known facts are given on page 254 of my paper (1912). This, however, he unfortunately never lived to do, for the sketch was dated February, 1685, and he died two years later in his seventy-fifth year.

Of Christian Marcgrave I am able to give only this small but interesting bit of information. In my copy of the "Historia Naturalis Brasiliæ" by William Piso and George Marcgrave (Leyden and Amsterdam, 1648), which bears as a book-plate a coat of arms and underneath the word LAETVAERENNYDT and the name of the maker of the plate, there are on the fly leaf opposite the engraved title page two short handwritten sketches in French, one of Piso, the other of Marcgrave. At the close of that on Marcgrave is found this interesting statement:

> His brother Christian, born at Liebstadt in Meissen, was made a doctor by the Faculty of Medicine at Franeker in 1659, and occupied the chair of pathology at Leyden until death overtook him in 1687. We learn that his two books printed separately were afterwards united and published under the title "Opera Medica Duobus Libris Comprehensa," Amsterdam, 1715, in quarto.

Lower on the same page is found, in the same handwriting as the above, this sentence:

> Cet ouvrage a été vendu 32 francs a la vente des livres de M^r^ l'heritier.

Franeker is a town in Friesland whose university, founded in 1585, was abolished by Napoleon in 1811. "Cet ouvrage" of course refers to the "Historia Naturalis Brasiliæ." There is nothing whatever to indicate who this "monsieur the heir" was, whether heir of the man of the book plate or of an earlier or later owner.

One more point may be added. In a recent catalogue of Dulau and Co., of London, there appeared in an advertisement of Piso and Marcgrave's work the statement that the figures were engraved by de Bray. No information has been obtainable as to who de Bray was or why he was chosen to engrave these figures. That the work was very poorly done an inspection of the "Historia Naturalis Brasiliæ" shows.

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THE EFFECTS OF THE KATMAI ERUPTION ON MARINE VEGETATION

UNDER an appointment as scientist in kelp investigation in the United States Bureau of Soils[1] the writer visited the coast of southwestern Alaska in the summer of 1913. During June and July the coast of much of the region affected by the eruption of Katmai volcano in June, 1912, was visited. The events attending this eruption have been described

[1] This expedition was a part of the general investigation of the fertilizer resources of the United States carried on under the direction of Dr. Frank K. Cameron, of the U. S. Bureau of Soils.

by Perry;[2] the effects of the eruption as seen in June and July, 1912, by Martin;[3] the composition of the ash that fell at Kodiak by Fry;[4] and the effects of the eruption on land vegetation by Griggs.[5]

The eruption was a violent one and proved fatal to a considerable amount of life both plant and animal. It also modified, at least temporarily, the conditions of plant life on the eastern portion of the Alaskan Peninsula and on Kodiak, Afognak and Shuyak Islands and the neighboring smaller islands.

Katmai volcano is situated toward the eastern end of the Alaskan Peninsula. It is about 24 km. north of the nearest point of Shelikof Strait and about 104 km. southwest of Cape Douglas. The wind was westerly at the time of the eruption so that the regions principally affected were those situated immediately to the eastward.

Of the effects of this eruption on marine vegetation as seen in the two months following its occurrence, Martin says:

> Marine life was affected to a larger degree than would perhaps be expected. . . . Kelp is apparently dead as far as the eastern end of Afognak Island.

Such injury to marine vegetation as was still apparent when the writer visited this region, over a year after the eruption, had evidently resulted from one or more of the following causes: (1) the grinding effect of the floating pumice, (2) actual burial of plants by the deposit of ash, (3) the burial by the ash of rocks which had furnished anchorage for marine algæ, (4) the effect of poisonous gases on plants growing in the littoral zone or whose distal portions are kept at the surface of the water by floats.

[2] Perry, Captain K. W. (U. S. R. C. S.), extract from report, *The National Geographic Magazine*, 23, 824–832, 1912.

[3] Martin, George C., "The Recent Eruption of Katmai Volcano in Alaska," *The National Geographic Magazine*, 24: 131–181, 1913.

[4] Fry, William H., "The Mineral Content of Volcanic Ashes from Kodiak," Science, N. S., 36: 682, 1912.

[5] Griggs, Robert F., "The Effects of the Katmai Eruption on Land Vegetation."

Of the masses of floating pumice, as seen in August, 1912, Martin says:

> The pumice is being washed into the sea by the combined action of streams, waves and tides. There it forms great floating fields which migrate with the winds and tides and greatly impede the navigation of small craft such as ours. An immense field of pumice . . . visited our anchorage at Takli Island. . . . This visitor came and went under the influence of tidal currents and winds, and constituted a menace which led us to seek a more sheltered nook for our boat. Even this was invaded by the floating rock, which jammed tight around and carried our boat with it when it moved, in spite two anchors and two pieces of pig iron down, and forced us to make fast to a projecting cliff. The floating pumice was twelve inches thick alongside the boat and possibly was much thicker in the center of a large field. Fishermen reported a pumice field dense enough to support a man in Shelikof Strait.

In July, 1913, the schooner from which we were conducting the kelp investigation passed through fields of floating pumice more than 241 km. west of Mount Katmai. Some of these fields were as much as 213 m. long and 15 m. wide. In several places the fields were so dense that we scooped up quantities of pumice with a dip net as our schooner passed through them. Drifts of pumice 20 cm. or more in depth were found in August over considerable areas on the beach of a lagoon opening from Popof Strait in the Shumagin Islands. In the region principally affected by the volcanic eruption we found considerable quantities of pumice drifted up on the beaches but did not encounter any floating fields of it. Reports from residents agree, however, that there were extensive fields in Shelikof Strait, Kupreanof Strait and other waters of the region in 1912.

Undoubtedly the grinding effect of the continued movement by tides and waves of the rough pieces of pumice composing these floating fields must have caused considerable injury to beds of *Nereocystis luetkeana* and *Alaria fistulosa*, both of which species are anchored to the bottom and are provided with floats that keep the distal portion of the plant at the surface of the water.

There are some reasons for believing that the grinding effects of these huge masses of rough pumice would be more destructive to *Nereocystis* than to *Alaria*. The growing region of *Nereocystis* is at the bulb, which floats on the water. It is from this growing region that the stipe elongates at its distal portion and the fronds elongate at their base. Serious bruising of this would undoubtedly kill the plant. *Alaria*, on the other hand, has its growing region near the base and the distal end of the frond is usually more or less frayed and ragged as a result of the action of tides and waves. This kelp has continuous regeneration of the frond from this growing region which is so far below the surface of the water as to be safe from any direct injury by floating materials of any kind, and it is possible that individuals might be still living although portions at the surface of the water looked worn and dead. We found considerable beds of *Alaria* at many places on the south shore of Shelikof Strait and at a few places on the north shore. A bed was found at Cape Atushagvik only about 38 km. from the volcano.

At the time of our visit *Alaria* was much more abundant in the region affected than *Nereocystis*. There were many beds of pure *Alaria*, but there were very few of pure *Nereocystis*. There were only a few cases in which the two species were mixed throughout the bed. These facts can not, however, be taken as indicating that the injury was greater to *Nereocystis* than to *Alaria*, for they were true outside of the region affected by the volcano as well as in it.

A good deal of injury to *Fucus* and other plants growing in the littoral zone may also have been done by the grinding effect of this pumice. It is of course well known that *Fucus* has restorative regeneration of its fronds,[6] but we could not detect that this was any more common in the regions affected by this eruption than it was in other portions of Alaska or of Puget Sound. On several exposed rocks at Russian Anchorage (35 km. from the volcano) we found that practically all of the growing *Fucus* was young, much of it not yet producing spores. Among these young plants were found the harder basal portions of old fronds.

It seems quite possible that the softer portions of these plants had been killed by the grinding of the pumice. On other rocks close by, the growth of *Fucus* was abundant, and the plants were vigorous and in fruit. In addition to *Fucus* twelve genera of Algæ were found in the littoral zone at this point. These were all fairly abundant and were in good condition except that many of the red algæ were considerably faded. This, however, the writer has found to be the case locally at several points in Alaska and in Puget Sound. The genera that we found in the littoral and upper sublittoral zones at Russian Anchorage are *Ulva, Laminaria, Alaria, Agarum, Halosaccion, Callophylis, Hildenbrantia, Corallina, Porphyra, Gloiopeltis.*

The maximum fall of ash resulting from this eruption approximated 139 cm. Some portions of the northern shore of Shelikof Strait received as much as 76 cm. The southern shore of this strait received 51 cm. in some portions, and Kupreanof Strait received from the latter amount down to 18 cm. Wherever this deposit was heavy the result was that the Algæ in the flatter portions of the littoral zone were completely buried. In Kupreanof Strait and in the south shore of Shelikof Strait we saw but little effect of the ash on littoral seaweeds. At Russian Anchorage near Cape Atushagvik on the northern shore the results of the ash were more evident. On a flat beach at that place the covering of ash had resisted the action of waves and tides and occasional bunches of *Fucus* on rocks large enough to reach the surface of this layer of ash was all that was left of the littoral vegetation. Not only had the 1912 crop of *Fucus* been buried here but the 1913 crop had been seriously interfered with by the covering of the stones that would have served for anchorage.

It seems probable that in some places sufficient material has been deposited on the bottom

[6] See Setchell, W. A., "Regeneration Among Kelps," Univ. of Calif. Pub. Botany, 2: 139–168, 1905, and the literature there cited.

to cover the rocks and stones and thus destroy all opportunity for anchorage for kelps. When we lifted the anchor (from a depth of 8 fathoms) at Russian Anchorage it was well covered with volcanic ash.

Fry states that glass predominates in the three samples of ash from Kodiak examined by him. He found also feldspars, muscovite, apatite, hornblende, biotite and "undeterminable particles of what appear to be a ferromagnesium mineral." These three samples represented the three falls of ash that occurred in the few days following the first eruption on June 6, 1912. He says that there "glasses would probably react with the soil water" and that "no substances deleterious to plant growth were revealed by the examination."

The injury to marine plants by gas was probably less than from the causes cited above. The presence of sulphurous fumes in the atmosphere was not confined to the time of the eruption but was noted as late as August 16 at a distance of 350 miles north of the volcano. On August 15 at the mouth of Katmai River Martin notes that during a rain "the drops of water striking the eyes produced sharp pain, and brass and silver were tarnished by the drops." On July 27 sulphurous fumes were evident on board the U. S. revenue cutter *Manning* 193 km. east of the volcano. Vegetation on the volcano itself was annihilated. Martin says that the death line "came practically down to the sea 24 km. from the crater" and suggests a hot blast as the cause of the death of vegetation. It seems improbable that a hot blast or poisonous gases caused any great damage to marine plants.

Human interest in the effect of this volcanic eruption on marine vegetation centers chiefly around the two large kelps—*Nereocystis luetkeana* and *Alaria fistulosa*. These kelps, as Martin has noted, are an important aid to navigation. They are a warning to navigators of shallow water, and in a region where there are practically no aids to navigation except such as nature has provided, these kelps are really important. These two kelps (principally *Alaria*) are universally used by the natives of Kodiak Island and the neighboring islands as fertilizer for their potato gardens, and are in this way of considerable economic importance. The 1912 crop of beach grass and other grasses which are ordinarily used as pasturage and hay for the cows kept in this region was practically all destroyed by the volcano. During the winter that followed the few cattle that were still kept in the region are reported to have lived largely on what kelp was to be had on the beach. To these reasons for local interest in these kelps must also be added the fact that they are now to be considered as a possible source of potash fertilizer.[7]

Information obtained by personal interviews with residents of the region indicates that there was large injury to the 1912 crop of kelp, and that even the 1913 crop was far short of that of the years preceding 1912. It seems that the beds became much thicker later in the season than they were at the time of our visit. A reliable informant reports that in December, 1913, the kelp was practically continuous from Afognak village to Little Afognak village. There were only scattering beds at that place when we visited it in June and July.

The fact that there was, previous to 1913, practically no information as to the relative amount of *Nereocystis* and *Alaria* in the region makes it impossible to say which of these suffered more damage as a result of the eruption. It seems probable that both of these species mature from spores in a single year,[8] so that where there were enough individuals left for "seed" the crop would soon become

[7] Cameron, F. K., *et al.*, Sen. Doc. 190, Sixty-second Cong., second session, 1911; "Possible Sources of Potash in the United States," Yearbook U. S. Dept. Agr., 523–536, 1912; "Kelp and Other Sources of Potash," *Jour. Frank. Inst.*, 176: 347–383, 1913.

[8] On the duration of *Nereocystis luetkeana*, see Frye, T. C., "*Nereocystis luetkeana*," *Bot. Gaz.*, 42: 143, 1906; Setchell, W. A., "*Nereocystis* and *Pelagophycus*," *Bot. Gaz.*, 45: 125, 1908; Rigg, G. B., "Ecological and Economic Notes on Puget Sound Kelps," Sen. Doc. 190, Sixty-second Cong., second session, 179–193, 1911; "Notes on the Ecology and Economic Importance of *Nereocystis luetkeana*," *Plant World*, 15: 83–92, 1912.

normal again unless the environment had been essentially changed.

In the main, the effects of this eruption on marine vegetation were temporary. The burial of rock that had served for anchorage will no doubt interfere permanently in some places with algæ in the littoral zone. It is possible that this same cause may also lessen the production of the two large kelps, *Nereocystis luetkeana* and *Alaria fistulosa,* but the evidence now at hand indicates that these kelps are well on their way toward recovery.

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EFFECT OF LIGHTNING ON A REINFORCED CONCRETE AND STEEL DOME

OWING to the increased use of reinforced concrete for buildings I have thought that an account of the effects of lightning on a metal dome surmounting walls of this construction may be of some general interest and of particular interest to astronomers.

On the afternoon of January 2 last occurred the heaviest thunderstorm in the immediate vicinity of the observatory since I came to Córdoba. The conditions were well marked—the weather had been very hot and sultry for several days, the barometer had been falling steadily and was low. The center of the storm, judging from the clouds and their motions, was not over a mile south by southeast of the observatory. In an area between one and two miles in diameter the clouds were very dark and low and masses of dark scud moved about underneath them.

In nearly all the storms which I had seen here previously the discharges were nearly all between clouds. (Perhaps because most of them occur at night?) In this storm nearly all of the discharges were between the clouds and earth.

Very heavy single flashes of lightning began about $2^h\ 20^m$ P.M. Córdoba time—apparently under the blackest part of the clouds and not over a half mile away. All of these which I saw were discharges between the clouds and earth, as also with only one exception, were all which discharged within a half mile of the observatory.

The direction of motion of this storm, as is usually the case, was from south to north. After some half dozen discharges close to the south there was a heavy one to the northwest about three hundred meters away—then another to the northeast about the same distance.

On account of this being a heavy storm and apparently passing directly over us, I was interested to see what the effect would be on our two new reinforced concrete walls and steel domes sheathed with galvanized iron, and was outside among the central group of buildings and not over 100 feet from the dome in question, one of them in full sight.

A minute or two after the flash to the northeast, mentioned above, there was a general illumination close by, followed almost instantly by the ripping sound of a very close stroke. The interval between the flash and the sound was certainly not over $\frac{1}{10}$ second. To me the sound appeared to be made up of three or four separate discharges blended into one—not consecutive.

I was standing within a few feet of the machine shops in easy hearing of the noise of the machinery. This noise stopped instantly after the flash. The main fuse on the light circuit had been blown twice before the flash, probably by induced currents. It was also blown again at the time of the flash.

Mr. Mulvey was in the underground optical shop at the time and thought there had been an explosion in the shop. He saw a flash and immediately afterward the lights went out. It was later ascertained that one lamp had burned out, which probably caused the flash which he saw in the shop. No other damage was done there. The circuits and machines were carefully examined but aside from the fuses being blown at the pump motor, on the 220-volt alternating current no sign of a spark was found.

The power and light currents were cut off until about 6 P.M., when it was found that fuses had been blown on our lines (which were special ones) just outside the step-down-station, some 400 meters away. No other effects of the storm were noticed in or near this station.

The dome which had just been completed was barely out of sight from where I stood and no one at the observatory seems to have seen the actual flash. A peon however in the grounds of the Meteorological office about 100 meters away had a full view of both domes and buildings, was facing them and saw the flash just over and about the new dome. This accords well with the direction and distance from my point of observation.

After hearing of this observation I made a careful examination of the dome and in particular the connection of the copper cable with the track upon which the dome revolves, which forms the connection between the metal dome and one of the vertical I beams imbedded in the concrete for grounding the circuit. The lightning-rod proper extends about a meter above the highest part of the dome and terminates in a brush of heavy wire. No signs whatever of any discharge have been found at any point about the dome.

Close to the dome stands the wooden derrick which was used in its construction, the top of which is about two feet higher above the ground than the lightning-rod. Three wire cable guys lead off to trees, two of which actually touch the ground—but scarcely so—and a fourth to a brick building. The cable used for lifting did not touch the ground. Careful examination of all of these points failed also to disclose the slightest sign of a spark.

The three wires of the alternating power circuit pass close to both dome and derrick.

About 70 or 80 meters east and west are, respectively, three lightning rods on the director's residence, and one on the assistants' house. To the south some 100 and 150 meters, respectively, are the metallic tower for the windmill and water tank, about 50 feet high and the first astronomer's residence with two lightning points.

I have been particular in referring to these various conductors, for it seems probable that so many must have been instrumental in reducing the difference of potential somewhat.

The bolt which struck the dome was undoubtedly not a light one for it frightened badly a number of persons in the residences near by and was described by several as a very bright flash. I do not think, however, that it was an especially heavy one, possibly not so heavy as most of the others which struck in the vicinity.

The peon who saw it from the neighboring quinta, was seated at the time under a shed and watching the dome. He says the flash appeared to descend as a single ray, striking the lightning rod and then the whole surface of the metallic dome appeared to be covered with sparks or flashes.

At the time the bolt struck there was a peon inside the closed dome, cleaning the running-gear. When questioned he said he had felt nothing nor had he noticed anything unusual beyond the heavy noise.

It seems certain, therefore, that the dome was actually the principal point of discharge for a fairly heavy flash of lightning. (It is uncertain how much of the discharge was taken by the derrick, but it would appear to have been relatively small.) That the induced currents in the light and power lines were sufficiently heavy to blow the fuses in both.

This experience seems to be a fairly severe test for such a construction—a metallic dome surmounting concrete walls which are heavily reinforced with iron—the metal in the walls having a good ground connection and being connected also with the dome.

From the effects in this case one concludes that after the resistance of the air was broken down, the dome and metal in the walls were ample to carry off the discharge without the slightest apparent damage to either the structure or the man who was inside at the time.

C. D. Perrine

Observatorio Nacional Argentino,
Córdoba

SCIENTIFIC NOTES AND NEWS

An international committee has been formed to establish a foundation in memory of Henry Poincaré. A medal will be struck in his honor, and a fund will be established under the Paris Academy of Sciences to en-

courage or reward young scholars engaged in work in the directions in which Poincaré led, namely, mathematical analysis, celestial mechanics, mathematical physics and scientific philosophy. The members of the executive committee are Messrs. Appell, Lamy and Daboux, and there is a large and distinguished international committee. Copies of the medal will be sent to subscribers, who should send their subscriptions to M. Ernest Lebon, Rue des Écoles 4, Paris.

DR. ERWIN BAUR, of Berlin, who was to have been the Carl Schurz memorial professor at the University of Wisconsin during the first semester this year, was stopped by the English on his way to Java and was held for a time at Port Said. He managed, however, to get away and, after many difficulties, to return to Berlin, where he is now stationed in the Marine Office. It will be impossible for him to come to America before the end of the war.

DR. WOLDEMAR VOIGT, professor of mathematical physics at Göttingen, exchange professor from Germany, will probably not be able to give his courses at Harvard University during the second half-year, although it is still hoped that the war may not interfere with the arrangements between Harvard and the French and German universities.

PROFESSOR PIERRE BOUTROUX, of the department of mathematics of Princeton University, has remained in France in the service of the French government.

The British Medical Journal states that Dr. Noyons, professor of physiology, at Louvain, has recently distinguished himself by his heroic conduct in remaining with his wife among the ruins of Louvain ministering to the wounded—Germans as well as Belgians. When the population of the city was informed that every inhabitant of the town must leave immediately, in order that the town might be razed to the ground by artillery, Dr. Noyons and his wife decided to remain in order to protect the 150 wounded who could not be removed in time.

DR. WILHELM FOERSTER, professor of astronomy at Berlin, who holds a doctor's degree from Oxford, takes objection to the movement to renounce English degrees in a letter to the *Berliner Tageblatt,* quoted in the London *Times,* on the ground that it is unwise to proclaim a divorce from the "learned world" of England because of England's "wicked policy."

DR. EUGEN DE CHOLNOKY, professor of geography at the University of Kolozsvár, Hungary, has been elected president of the Royal Hungarian Geographical Society, Budapest, for the term expiring in 1917. The former president, Professor Louis de Lóczy, director of the Royal Hungarian Geological Survey and the well-known China explorer, became honorary president.

DR. OTTO FINSCH, the well-known ethnographer and geographer of Brunswick, celebrated on August 8 his seventy-fifth birthday.

DR. MAYNARD M. METCALF, professor of zoology at Oberlin College, has retired from the faculty and is devoting his entire time to research in a private laboratory recently erected on his own grounds.

SIR ERNEST SHACKLETON and the members of his Transantarctic Expedition left London on September 18 for the South Polar regions. The explorers departed in two sections, the portion for the Ross Sea or New Zealand side of the Antarctic leaving in the morning *via* Tilbury for Tasmania, and the Weddell Sea section, including Sir Ernest Shackleton, leaving for South America later in the day. The *Endurance,* the ship of the Weddell Sea party, left Plymouth on August 8. The Ross Sea ship *Aurora* is to leave some Australian port about the beginning of December.

DR. W. S. BRUCE, of the Scottish Spitzbergen Expedition, accompanied by Mr. J. V. Burn-Murdock, Mr. R. M. Craig and Mr. John H. Keoppern, arrived in the Tyne from Bergen on September 18. The party left Newcastle on July 9 for scientific exploration in Spitzbergen.

Professor R. H. Whitebeck, of the department of geology and geography of the University of Wisconsin, has been granted a leave of absence for the present semester and will spend the time in research work with the Carnegie Institution at Washington.

Dr. Lemuel Bolton Bangs, a prominent surgeon of New York City, professor in the University and Bellevue Hospital School, died, on October 4, at the age of seventy-two years.

The death in announced at the age of eighty-three years of Mr. Edward Riley, who was early associated with the production of Bessemer steel.

Sir Henry G. Howse, at one time senior surgeon to Guy's Hospital, and president of the Royal College of Surgeons, England, has died at the age of seventy-three years.

Dr. Eugen von Böhm-Bawerk, professor of economics in the University of Vienna, member of the Austrian upper house and formerly minister of finance, president of the Vienna Academy of Sciences, died on August 27, at the age of sixty-three years.

Dr. H. J. Johnston-Lavis, professor of vulcanology in the University of Naples, was killed in a motor accident last month.

The British Medical Journal calls attention to the fact that Louvain was in old times, as it is still, chiefly celebrated as a school of theology, but for anatomists it is associated with the great name of Andreas Vesalius. The reformer of anatomy was a student in the *pædagogium castri* and also in the *Collegium Buslidianum*, where he gained that knowledge of the ancient tongues which was to prove of such service to him in the scientific controversies of his later life. It was when he was at Louvain that Vesalius secured a human skeleton by climbing the gallows outside the town. He had to convey the bones home secretly, reentering the town by a different gate from that by which he had gone out, and articulating his stolen treasures in his rooms. He was afterwards spared the work of "resurrection" by the liberality of the burgomaster, who placed abundance of material for dissection and demonstration at his disposal. In 1536 or 1537 he dissected and lectured publicly. He seems, however, not to have been altogether comfortable in the theological atmosphere at Louvain, and some remarks which he made on the seat of the soul excited the suspicions of the heresy hunters.

In 1902 Dr. and Mrs. Christian A. Herter, of New York, gave to the Johns Hopkins University the sum of $25,000 "for the formation of a memorial lectureship designed to promote a more intimate knowledge of the researches of foreign investigators in the realm of medical science." According to the terms of the gift, some eminent worker in physiology or pathology is to be asked each year to deliver lectures at the Johns Hopkins University upon a subject with which he has been identified. The selection of the lecturer is to be left to a committee representing the departments of pathology, physiological chemistry and clinical medicine, and if "in the judgment of the committee it should ultimately appear desirable to open the proposed lectureship to leaders in medical research in this country there should be no bar to so doing." The committee named for this purpose consists of Drs. Welch, Abel and Barker. The eighth course of lectures on the Herter foundation will be given by Thomas Lewis, M.D., lecturer on diseases of the heart, University College Hospital Medical School, London. The lectures are being given in the auditorium of the Physiological building, at 4:30 P.M., as follows:

I. *October 6.*—"Observations Exemplifying Electrocardiography."

II. *October 8.*—"The Relation of Auricular Systole to Heart Sounds and Murmurs."

III. *October 9.*—"Observations upon Dyspnœa, with Especial Reference to Acidosis."

An examination for a food chemist at a salary of $100 to $150 a month under the civil service of the State of Illinois will be held on November 7. Further information can be obtained from the Illinois State Civil Service Commission, Springfield, Illinois.

THE Fuertes Observatory, of Cornell University, is to be torn down and rebuilt on a site north of Fall Creek Gorge, northeast of the campus. It will stand on a slight knoll at the southwest corner of the Hasbrouck farm, near the upper end of Beebe Lake.

THE Royal Zoological Society of New South Wales has begun the publication of *The Australian Zoologist,* the first number of which contains the annual report of the council of the society and of the zoological gardens that it conducts. The publication also contains a number of articles concerned with zoology in Australia.

LAST year the imports of mineral products, both crude and manufactured, exceeded $270,000,000. Of this total probably $200,000,000 represents raw materials and crude metals, the value of these imports being about 8 per cent. of that of the domestic output. In this list of imports the larger items named in the order of value are unmanufactured copper, precious stones, nitrate of soda, copper ore and matte, nickel, tin, iron ore, pig iron and steel, petroleum products, manganese ores and alloys, platinum, aluminum, pyrite, graphite, stone, potash and magnesite. This country has an abundant supply of most of these mineral products that are now imported in large amounts, and as to them it can be independent of foreign countries. The only essential minerals of the first rank of which the United States has no known supply at all commensurate with its needs are nitrates, potash salts, tin, nickel and platinum, the list thus comprising two essential mineral fertilizers and three very useful metals. There was a decrease in the output of magnesite in the United States from 10,512 short tons, valued at $84,096, in 1912, to 9,632 tons, valued at $77,056, in 1913. The only production in this country was in California, as heretofore. With the cutting off of the foreign supplies, due to the European war, however, the demand for the domestic product ought to increase greatly, especially in view of the new and shorter water route by way of the Panama Canal to the eastern United States. It is to be hoped that the sudden stimulus thus given to the domestic mining industry will build up a trade that will withstand the competition that must undoubtedly ensue when normal trade conditions are again established. The demand for the domestic product is restricted to the Pacific coast and Rocky Mountain region, as it has been impossible at the present railroad freight rates to ship to the points of largest consumption in the East. In answer to inquiries addressed to them by the Geological Survey, many owners of idle magnesite properties in the far West express the belief that with the opening of the Panama Canal they would be able to ship magnesite by sea to the east at a profit. Magnesite is used principally in the manufacture of refractory substances, such as brick, furnace hearths, crucibles, etc.; as magnesium sulphite, for digesting and whitening wood-pulp paper; in the crude form for making carbon dioxide; calcined and ground for the manufacture of oxychloride cement; and for miscellaneous applications in crude form or as refined magnesium salts. In the toilet and bath rooms of the rest rooms of the Panama-Pacific Exposition at San Francisco, magnesite flooring has been laid, about 5,000 square feet having been put down in each of the main buildings. The domestic product is used in this work. A copy of the advance chapter from "Mineral Resources for 1913" on the production of magnesite in 1913, just issued by the U. S. Geological Survey, may be obtained upon application to the director.

THE United States Bureau of Mines, in cooperation with the United States Geological Survey, has undertaken additional and more comprehensive investigations pertaining to the problem of mine caves and surface support. The immediate work of the mining engineers and geologists will comprise detailed studies of the extensive open-cut and underground mining operations in southwestern New Mexico. The field investigations will be conducted with special reference to earth pressures and surface subsidence in relation to the geological formation and mining conditions, and the equipment and efficiency of the

large mechanical installations in operation there. The Bureau of Mines, it will be remembered, has already done a large amount of work in the problem of mine caves. Director Holmes and several mining engineers served in an advisory capacity on the board of the Scranton Mine-Cave Commission. Mining engineers of the bureau gave the subject special attention in their studies of European mining methods and conditions. A mining engineer of the bureau served as a member and represented the cooperation of the bureau on the Pennsylvania State Anthracite Mine-Cave Commission, and in the investigations conducted in connection therewith extensive tests of mine-roof supporting materials were made at the Pittsburgh Experimental Station. The mining engineers and geologists of the bureau cooperated with the Scranton City Council, the Bureau of Mine Inspection and Surface Support, consulting engineers, and the Surface Protective Association in studies and reports for the development of practicable solutions of the serious mine caves occurring during recent years. Charles Enzian, mining engineer of the anthracite region, under the direction of Chief Mining Engineer George S. Rice, will represent the Bureau of Mines in this cooperative investigation.

UNIVERSITY AND EDUCATIONAL NEWS

The new buildings and grounds of Richmond College were occupied at the beginning of the academic year. After eighty-two years on the site in the heart of the city of Richmond, the college opens the session of 1914–15 in new buildings on a campus of 150 acres in the western suburbs of the city. The opening of Westhampton College, the new coordinate college for women, occurred on the same day. The new grounds and buildings of Richmond College for men have a valuation of $850,000 and those of Westhampton College for women of $400,000. The buildings are of collegiate Gothic architecture and were designed by Messrs. Cram and Ferguson of Boston and New York.

Captain Thomas J. Smith, of Champaign, Ill., has given land, valued at more than two hundred thousand dollars, to the University of Illinois, to make possible the erection of a building to house the department of music.

At the opening of the Boston University School of Medicine, Dean Sutherland announced that a gift of $100,000 had been received for the establishment of a maternity hospital.

We learn from the London *Times* that the Belgian minister in London has received a letter from the council of the senate of the University of Cambridge offering to professors, teachers and students of the University of Louvain such facilities in the way of access to libraries, laboratories and lectures, together with the use of lecture-rooms, as may secure the continuity of the work of that university during the present crisis. While the University of Cambridge is not in a position in its corporate capacity to offer direct financial assistance for the support of members of the University of Louvain, efforts are being made in Cambridge to provide such help privately. Mgr. Barnes, Roman Catholic chaplain of the University of Cambridge, has explained that the university had invited the University of Louvain to migrate to Cambridge, and there to continue its own separate studies, granting its own degrees and generally continuing its activities as at its own foundation, Cambridge supplying the facilities necessary for the technical carrying out of the work. Hospitality in the way of living accommodation and so forth would probably be offered by the individual colleges and by private residents. Through the American Legation at The Hague the professors of the University of Oxford have offered a home for the winter to the young children of the professors of the ruined University of Louvain. Dr. van Dyke has sent the message by two messengers over two different routes, hoping that one or the other may carry it through. The academic staff of University of London, University College, are prepared to offer hospitality to about 70 members of French and Belgian universities, whether professors, teachers, or students, men or women, who may find it necessary to

take refuge in England. Special arrangements will be made as far as possible to meet the needs of French and Belgian students who desire to continue their studies in London.

PROFESSOR FRANK H. CONSTANT, formerly of the University of Minnesota, becomes head of the department of civil engineering at Princeton University, succeeding Professor Charles McMillan, who has retired and been elected professor emeritus.

JOHN E. BUCHER, associate professor of chemistry at Brown University, has been promoted to be head of the chemistry department to fill the vacancy caused by the retirement of Professor John H. Appleton. Dr. Harold Bigelow, of Mount Alliston University, is added to the faculty as assistant professor of chemistry.

DR. CHARLES ALTON ELLIS, formerly of the University of Michigan, and recently engaged as a practising engineer, has been appointed assistant professor of civil engineering in the University of Illinois.

DR. E. HAYNES, of the Lick Observatory, has been made associate professor of astronomy at Beloit College and director of the Smith Observatory.

J. CROSBY CHAPMAN, B.A. (Cambridge), D.Sc. (London), Ph.D. (Columbia), has been elected assistant professor of experimental education of Western Reserve University.

AMONG the new faculty appointments at Oberlin College the more important are the following: Dr. H. N. Holmes as professor of chemistry and head of the department. Dr. Holmes received his A.B. from Westminster College in 1899 and the doctorate from Johns Hopkins in 1907. He comes to Oberlin from Earlham to succeed Professor Allen W. C. Menzies who goes to Princeton. Dr. H. A. Miller has been made professor of sociology and head of the department. Dr. Miller received his A.B. from Dartmouth in 1899 and his Ph.D. from Harvard in 1905. He comes from Olivet College. Dr. George R. Wells is promoted to be associate professor of psychology and Dr. E. M. Kitch enters the department of philosophy as associate professor after two years of study in the University of Chicago.

CHANGES in the scientific staff of the University of Idaho have been made as follows: Dr. Chester Snow, associate professor of mathematics; Dr. John J. Putnam, associate professor of bacteriology, in charge of the department; Associate Professor C. W. Hickman, department of animal husbandry; Mr. Newell S. Robb, in charge of the department of agronomy; Assistant Professor O. W. Holmes, department of dairying; Professor C. E. Coolidge, mechanical engineering; Professor A. M. Winslow, civil engineering, and Mr. L. W. Currier, metallurgy and geology department.

MR. STANLEY F. BROWN and Dr. Wm. M. Thornton, Jr., have been appointed tutors in the department of chemistry, College of the City of New York.

DR. J. E. ROWE, of Dartmouth College, has been appointed assistant professor of mathematics in the Pennsylvania State College.

PROFESSOR R. H. YAPP has been appointed professor of botany in the Queen's University, Belfast.

MR. L. J. GOLDSWORTHY has been appointed professor of chemistry at the Victoria College of Science, Nagpur.

DISCUSSION AND CORRESPONDENCE

AN EXPERIMENT ON KILLING TREE SCALE BY POISONING THE SAP OF THE TREE

I HAVE in my grounds a plant of Spanish broom about a dozen years old and with a trunk about four inches in diameter which has for several years been seriously infested by cottony cushion scale (*Icerya purchasi*). I have tried various sprays, have put scale-eating beetles on the tree and at one time cut all the branches off and sprayed the trunk several times in the attempt to get permanently rid of this scale, but up to last winter it seemed that all attempts were in vain. In February of this year, when the broom was very thickly covered with the scale I bored a $\frac{3}{8}$ in. hole in the trunk to a depth of about three inches, filled the hole nearly full of crystals of potassic

cyanide and plugged it up. In two days the scale began to fall from the tree and in a few days all appeared dead. Others hatched and attacked the tree, but lasted only a short time, and the tree has since been free from scale and very vigorous.

At the same time I bored a similar hole in an old peach tree which seemed to have passed its usefulness and put a like charge of potassic cyanide in it. The tree has since seemed more vigorous than before, and raised a fair crop of peaches. After feeding some of them to chickens and a rabbit with no apparent ill result, I ate some of the peaches, and could find nothing wrong with them. I have since put a similar charge of the cyanide in an orange tree with no apparent bad effect.

It would seem from this experiment that it is possible in some kinds of trees, at least, to poison scale and sap-eating insects without injury to the tree. The method would seem to be especially adapted to killing various kinds of borers and insects which, like the pine beetles, burrow beneath the bark.

Fernando Sanford
Stanford University, Cal.,
September 3, 1914

Laboratory Cultures of Amœba

To the Editor of Science: While *Amœba* may appear in hay infusions within five days, even when in sufficient quantity, it is often not desirable for laboratory study on account of its extremely small size. Again standard textbooks of general biology give tolerably certain methods for obtaining the organism, within, however, a much longer time—in some cases from 5 to 6 weeks. The writer hopes that certain notes on this part of the laboratory routine may be of help.

In preparing laboratory cultures of *Amœba* during the past three years, he has been led to collect material for his infusions from a number of different types of environment—stagnant and freshwater ponds, swamps, sewage polluted streams, etc., and to make *composite* cultures of the material obtained. Such cultures, if not infertile, in the writer's experience rapidly attain the peculiar balance necessary for the flourishing growth of the organism, and yield in a comparatively short time, in one case as early as six days, a type of *Amœba,* which, if not always large, presents considerable advantage over that inhabiting the hay infusion. Such cultures have been available for study as long as eight days. Very frequently, too, there are produced an abundance of Spirillæ, etc., which the *Amœbæ* obligingly ingest, while the whole microcosm seems to be one superior to that obtained in the infusion as ordinarily made. A number of control cultures made at the University of Pittsburgh and the Osborn Zoological Laboratory, Yale University, showed that *Amœba* eventually appeared in one or more of the components of the composite culture, but in every case later. Without any attempt at explanation, it seems to the writer, that there may be some parallelism between the condition of environment obtained in such a composite culture and that in the "varied environment medium" as described by Woodruff.[1] In conclusion, it is noted that the results of the experiments have always remained fairly uniform, although widely separated geographical localities have been involved.

N. M. Grier
Biological Laboratory,
University of Pittsburgh

The Origin of Mutation

The word mutation appears to have suddenly arisen in 1650, according to Lock. It appeared again independently two hundred and nineteen years later. This recent advent (1869) has been termed the "Mutations of Waagen" (1912). Darwin at times spoke of species as "mutable," and de Vries (1901) has made the word famous.

Since in the pages of this journal and elsewhere in the States there has been an attempt to show that the word was preoccupied in a sense different from that in which de Vries used it, the following quotation from Lock, "Recent Progress in the Study of Variation, Heredity and Evolution,"[2] may be interesting.

[1] *American Naturalist,* XLII.
[2] Third edition, 1911, p. 124.

Perhaps the earliest use of the actual word "mutation" in this sense is to be found in "Pseudodoxia Epidemica," by Dr. Thomas Browne. I quote from Book VI., Chapter X., "Of the Blackness of Negroes":[2] "We may say that men became black in the same manner that some Foxes, Squirrels, Lions, first turned of this complection, whereof there are a constant sort in diverse Countries; that some Chaughes came to have red legges and bills, that Crows became pyed; All which *mutations*, however they began, depend upon durable foundations, and such as may continue for ever."

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PLEA FOR A STATUE IN WASHINGTON TO PROFESSOR SPENCER FULLERTON BAIRD

TO THE EDITOR OF SCIENCE: In Lafayette Square, opposite the White House in Washington, there are five statutes in bronze, all of heroic proportions. They are of military characters, only one of them being that of an American. Each commemorates deeds of war and bloodshed, and their accessories consist of the implements and munitions of warfare. In the various parts of this city, within and without the majority of the federal and municipal buildings, and in the museums, there are a great many statues—some in stone, some in metal—which have been erected to prominent characters in American history. A few of these are of foreigners, while the majority of them are of our own countrymen. In some instances, the same person had two or more such statues erected in his honor, while General Washington has apparently been favored with a half dozen or more.

Again, these duplications invariably have military men as their subjects; and the greater their exploits were in the way of leading men in battle, in which thousands of their enemies were slain, the more likely are we to find them thus distinguished. It is safe to say that at least eighty-five per cent. of all such statues to be found in the city of Washington are of military men; and it is truly discouraging, as well as disgraceful, to note how very few there are which have been erected to writers or to men of science in any of its many departments.

[2] Second edition, 1650.

On the Smithsonian grounds there is one to Professor Joseph Henry, and Doctor Samuel D. Gross has been similarly honored in a fine statue which appears on the grounds of the Army Medical Museum. A very few others are to be seen about the city or in the public buildings, not half a dozen altogether thus commemorating the works of any of our great astronomers, chemists, biologists, surgeons, artists, inventors and others who have long ago passed away, while their works and discoveries still redound to this nation's credit, advantage and welfare, and that with ever-increasing force and volume.

In line with the city's improvements, there has recently been formed a small, park-like, subtriangular square, at a point where, in the near future, there will be a grand entrance to the National Zoological Gardens. This is situated at the intersections of Sixteenth Street, Columbia Road and Mount Pleasant Street, in a section which promises some day to be one of the most attractive parts of the northwest part of the city.

There could be no better locality than this one, anywhere in the nation's capital, upon which to erect a statue to Professor Baird, nor could any one be selected, from among those who have gone before in science, to more appropriately occupy this spot than he.

Not only was Professor Baird largely responsible for the establishment of the National Zoological Gardens and Park; but, as every scientist is fully aware, from one end of the world to the other, he, of all others, did more during his lifetime to augment and build up American zoological science, to start and encourage the younger members of the profession, and withal to very materially add to the literature of biology as a whole, as he was the author and co-author of several formal volumes on natural history and of over a thousand papers on allied subjects. The establishment of the U. S. Bureau of Fisheries is almost wholly due to his energy and foresight; while as secretary of the Smithsonian Institution he has left a record which, for scientific achievement, enterprise and actual accomplishment, has never been in any way ap-

proached, and it will remain unique for many generations to come.

I am sure that the great body of scientific people of this country will be in full sympathy with the proposition here made, and it should not be a difficult matter to select and appoint a committee to carry it out successfully. The sanction of Congress can doubtless be readily secured, and the necessary means for the purpose easily obtained through subscriptions from American scientists and scientific institutions.

R. W. Shufeldt

Washington, D. C.

Belgian Professors and Scholars

To the Editor of Science: It would seem to me that the present time is a particularly appropriate one for our university administrators and other organizations having to do with educational exchanges with Europe to give a special consideration to professors in Belgium. It is well known that in the universities of that country there are many men eminent in the different departments of learning, and in the present necessarily deranged conditions in their own country, an opportunity to teach, or work in laboratories, in America might be particularly welcome. There could naturally be no thought of a completion of the exchange by sending Americans to Belgium at this time.

It might also be a useful thing if some of the generous benefactors of American institutions could establish at least temporary fellowships or scholarships in appropriate American institutions, carrying with them a stipend fully sufficient for academic, traveling and living expenses, for the benefit of young Belgians whose studies are interrupted by the war and who are not called to take arms in behalf of their country.

Edwin B. Frost

Yerkes Observatory,
September 30

Scientific Books

The Middle Triassic Marine Invertebrate Faunas of North America. By James Perrin Smith. U. S. Geological Survey, Professional Paper No. 83. Washington, Government Printing Office, 1914. 4°. Pp. 254, pl. I–XCIX.

Many years ago the author of this paper planned, with Professor Alpheus Hyatt, a monographic treatment of the Triassic invertebrate faunas of America. As time went on it became evident that Professor Hyatt's other engagements would prevent the carrying out of this plan. With his advice and assistance Professor Smith prepared a synoptic introduction to the Cephalopod fauna, issued as U. S. Geological Survey Professional Paper No. 40.

As the work went on it became evident that the material would be too bulky for a single volume, so the Upper, Middle and Lower Triassic were planned to occupy each a single volume.

That the Middle Triassic part is now first published follows from the fact that the manuscript was nearer completion than the others and contains more new material. The classification is that of the synoptic introduction above cited and is not repeated in detail in the present volume.

The Middle Triassic fauna consists in the main, as here shown, of Cephalopoda, with a few bivalves, brachiopods and echinoderms, but not a single gastropod.

Marine fossils of the Middle Triassic, according to Professor Smith, are known in North America, only from California, central Nevada and British Columbia. The Triassic of the eastern states is all non-marine. The continental deposits of Western America appear to have resulted from arid conditions, but the fossils of the marine sediments were laid down in an arm of the ocean and not in a closed basin like the Caspian Sea. This is indicated by their close relation, faunally, to those of the other Pacific borders and to the ancient sea which in Mesozoic time covered a large part of southern Asia. The Middle Triassic of Western America is divided into two zones, the lower having a mixture of boreal and East Indian types and called after its zone-fossil, *Parapopanoceras;* the upper, with a Mediterranean fauna, plus

some East Indian types and taking its designation from the bivalve *Daonella dubia*.

A certain kinship still exists between the Middle Triassic faunas of western America and Asia, due perhaps to common descent as much as to migration. The relationship with the Eurasian Mediterranean or "Tethys" fauna begins to be strong, especially among the Ceratitidæ. In the west Humboldt range of Nevada about twenty-five per cent. of the species are either identical with, or closely related to forms of the same age in the Mediterranean region. The faunas of the latter and of America are more closely related to each other than either is to the boreal or to the East Indian fauna. These propositions are exhaustively illustrated by tabulation of the species. A full bibliography of the subject is given, followed by descriptive matter which contains comparative data of great value, the more welcome because so seldom furnished by authors. The plates are admirable and the typography such as usually comes from the Government printing office. It may save some student time to know that "Plate one" on pages 144 and 145, should read "Plate fifty." W. H. DALL

Monograph of the Shallow-water Starfishes of the North Pacific Coast from the Arctic Ocean to California. By ADDISON EMERY VERRILL. Harriman Alaska Series, Volume XIV. City of Washington. Published by the Smithsonian Institution. 1914. Large octavo, 2 vols., text (xii + 408 pp.) and plates (110).

For many years the remarkable starfish fauna of the west coast of America has occupied a large part of Professor Verrill's time and attention, and these two fine volumes are the result of his study. The short preface recounts the varied sources of his material, which was very extensive and included nearly all of the important collections on the American continent. The original material on which Dr. William Stimpson based his species is fortunately still extant and the reproduction of photographs of many of his types is one of the notable features of Professor Verrill's book.

A large part of the material incorporated in the "Introduction" (pp. 1–19) has been published by the author previously in articles in scientific periodicals, but considerable new matter is also included. The whole makes up a very interesting, though somewhat fragmentary account of habits, senses, variability and other characteristics of starfishes in general and of the west coast starfishes in particular. The general morphology of the Asterioidea is then taken up (pp. 20–24) and naturally, the classification of the group is next discussed (pp. 24–26). The family Asteriidæ, which occupies more than two-fifths of the entire volume, is then treated in considerable detail; the morphology requires more than ten pages (27–39); the classification and the discussion of various genera and subgenera, many new, occupy pages 40–56; and a very detailed but useful key to west coast species of Asteriidæ fills pages 57–67.

There then follows (pp. 67–202) the full and often elaborate account of these species, beginning with the well-known *Pisaster ochraceus* (Brandt). It is interesting to note that Verrill makes the families Stichasteridæ and Heliasteridæ, as recognized by most former workers, subfamilies of the Asteriidæ, a change which is almost certainly in the right direction. The old, familiar genus *Asterias*, which others have sought to subdivide but generally on trivial grounds and with poor success, Verrill boldly transforms into the subfamily Asteriinæ, and divides, on more or less important morphological grounds, into more than twenty genera. It is greatly to be regretted that nowhere does Verrill bring his proposed genera together in an analytical table or key, for it is by no means easy to determine what the interrelationships of his groups are. There can be little doubt that many of these groups are valid genera, but it is hard to believe that all are. The difficulty of comprehending Verrill's opinions regarding the groups is complicated by the use of "subgenera" and "sections," which certainly seem superfluous, when one old, long-recognized genus is split into more than twenty!

In his treatment of species, too, Professor

Verrill must plead guilty to being a "splitter." He himself says that he has added "thirty additional species" of *Asterias,* in the old, broad sense, to "over twenty" previously known from the Northwest Coast, "besides twenty well-marked new varietal forms, or a total of about seventy." In fact, the free use of both subspecies and varieties has led to a regrettable complexity of nomenclature, which is at times almost if not quite quadrinomial. Thus we have the starfish *Leptasterias epichlora,* with four subspecies, under one of which, *alaskensis,* two varieties are recognized *carinella* and *siderea,* and we must therefore speak of these starfishes by means of *four* names. There are further three varieties listed (p. 139) regarding which we are not told of what they are varieties, so we do not know whether they are to be designated by three names or by four. The distinction between subspecies and varieties is not clearly made. On page 17, we are told that subspecies are "bathymetrical or geographical races," but on page 133 the range of *Leptasterias epichlora* is given as from Vancouver to Yakutat and Dutch Harbor, while on page 137, the range of the subspecies *alaskensis* is said to be practically the same. On page 138, *miliaris* is said to be a new subspecies, but throughout the description is referred to as a variety. Under the head of varieties, Verrill includes (p. 17) "local variations due to unfavorable environments, sports, freaks, or hybrids." And to these he thinks it necessary or at least desirable to give distinctive names. Of course, these matters are largely governed by individual judgment, but it can not be denied that such splitting tremendously complicates the task of mastering the group in which it is done. The present reviewer considers it both unnecessary and undesirable.

Including all of his new species, subspecies and varieties, Verrill publishes in this volume, some seventy new names. (Many have been previously printed in a couple of preliminary papers.) These names are as a rule well chosen, euphonious and distinctive, indicating some peculiarity of the form. Only nine are names of persons, but eleven are geographical. There are also no fewer than seventeen new generic names proposed, all of which are worthy of commendation.

The northwest coast starfishes, not Asteriidæ, are discussed very fully in the section pages 202 to 336. Such difficult genera as *Henricia* and *Solaster* are treated with skill and good judgment and much light is thrown on the interrelationship of the species in each genus. The section also includes much important morphological material and the discussion of many nomenclatural questions. In his treatment of these questions, Professor Verrill reveals not only a very extended knowledge of the subject, but a delightfully catholic and unprejudiced spirit. On nearly all important points Verrill finds himself in accord with the conclusions of Fisher, and even when he feels obliged to disagree with that writer, the disagreements are always most courteously expressed. The spirit in which all controverted points are discussed is one of the most admirable features of the book.

The section on geographical distribution (pp. 337–373) falls naturally into two parts. The first deals with the region extending from southern California to the Arctic Ocean. Four distinct, though more or less overlapping, faunæ are recognized, the species belonging to each being listed. The interrelationships of these faunæ, as well as their relation to those of other regions, is fully discussed. The second part of the section deals with the starfishes of southern South America, and also includes a long list of other extralimital starfishes, which are partially "described, revised or figured" in the work. The account of South American species includes important changes in nomenclature, descriptions of new genera and some discussion of the relationship of these genera to those of the north. A complete list of all the new genera proposed in the volume is given on page 374, and following that is an extended bibliography (pp. 374–388). A very satisfactory index completes the volume (pp. 389–408).

Professor Verrill is certainly to be congratulated upon the completion of this important work, which has occupied him for several

years. It will long be a standard reference book for the region it covers, while many of the analytical tables and keys will be of use elsewhere. The illustrations, particularly the volume of plates, are very fine and of inestimable value. It is rare indeed that better photographs of starfishes are seen. The Harriman Alaska Expedition did much to advance our knowledge of the zoology of the northwestern American coast, and the volumes containing its results are notable for contents and appearance alike. But among them all, none take a higher rank or make a better impression than do these volumes on the starfishes, by the Nestor of American systematists.

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MUSEUM OF COMPARATIVE ZOOLOGY,
CAMBRIDGE, MASS.,
June 17, 1914

The Weather and Climate of Chicago. By H. J. COX and J. H. ARMINGTON. Bulletin 4. The Geographic Society of Chicago.

The authors, for many years official forecasters at Chicago, are to be congratulated upon the completion of a laborious piece of self-imposed work. The volume is essentially the station Means Book *in extenso* with stress laid upon unusual and extreme conditions. Reading between the lines, one is conscious of the effort to deduce definite laws bearing upon forecasting, but the hope is not realized and indeed we are told that "careful examination fails to afford any clue by which the nature of a season or year may be foretold, from any of its predecessors."

The discussion of temperature occupies 148 pages, with 44 tables and 30 figures. Nowhere is there given an equivalent value in Absolute or Centigrade degrees. The mean annual temperature determined from doubtful records dating back to 1830, is 282° A. (48° F.), which does not differ greatly from the mean obtained from the official records, 1871–1910. The latter, however, are of somewhat doubtful value since they were made at no less than seven different localities. The table of daily normal temperatures on page 33 leads us to infer that the normals used by the Weather Bureau cover a period of 32 years only, while data for 42 years are at hand.

The highest temperature officially recorded is 312° A. (103° F.), and the lowest 242° A. (— 23° F.). The year 1911 was the warmest since the establishment of the office, if we accept the Federal Building records without correction. On 22 days the temperature reached or exceeded 305° A. (90° F.). This record was equaled in 1913. The greatest daily range was 290°–261° A. (62°–10° F.) which actually occurred between the hours of eight A.M. and midnight.

In discussing the effect of winds from Lake Michigan it is stated "the specific heat of air being less than one quarter that of water, the interchange of heat will result in a larger change of air temperature than of water temperature."

The meaning is not quite clear, but it should be remembered that while the specific heat of air (at constant pressure?) is 0.24, the specific heat of water vapor is twice this, and it is water vapor rather than air or water which is the effective temperature control. The cooling effect is noticeable at times far inland, but in general decreases rapidly with distance, often disappearing within 15 or 20 miles. The wind records need not, however, be taken too seriously, since the type of instrument used by the Weather Bureau gives only eight points of the compass, *i. e.*, one direction covers 45 degrees. A shift of 22 degrees could not be detected. Again, the elevations have been changed a number of times, making the velocities uncertain. Calculated on the basis of hourly frequency, northeast is the prevailing wind. The highest daily wind, 2,167 kilometers (1,347 miles), occurred at the Auditorium Tower, but the highest recorded at the present location is only 70 per cent. of this. The authors think that the present velocities should be increased 10 per cent. to be comparable.

The precipitation records likewise are open to criticism, owing to faulty exposures and frequent changes. The authors frankly state that the effect of the poor conditions at the Auditorium Tower can not be questioned.

Apparently Chicago receives the same precipitation as the surrounding prairie region. Unfortunately no hourly readings of relative humidity are available and the period of bi-hourly values shown in Table CXII. is much too short to establish with any degree of accuracy values for the various hours. A table of average monthly and annual relative humidities for 15 cities in the United States is given, but no mention made of corresponding temperatures. As it stands, the table is without value for comparative purposes.

The authors give generous credit to all who have helped in the work. The Geographic Society of Chicago has done well in making accessible data which otherwise might have remained buried in official files. The general make-up of the book is good.

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SPECIAL ARTICLES

SOME OBSERVATIONS ON THE FOOD HABITS OF THE SHORT-TAILED SHREW (BLARINA BREVICAUDA)

Of the six species of short-tailed shrews of the genus *Blarina* occurring in the United States, *Blarina brevicauda,* called the large blarina or mole-shrew, is the only one found north of the Austral region, and consequently is the only representative of the genus here in Massachusetts. It inhabits deciduous woodlands and fields, where it makes shallow tunnels that are often marked on the surface by little ridges.

This shrew is described as follows on page 11 of North American Fauna No. 10, U. S. Dept. of Agriculture:[1]

> General characters.—Size, largest of the subgenus (total length about 125 mm.); skull largest and heaviest of the American Soricidæ; pelage glossy. Color.—Sooty-plumbeous above, becoming ashy-plumbeous below, varying with the light; paler in summer; glossy in fresh pelage.
>
> It has a stout body, nose rather long and tapering, external ears not visible, eyes very small, front teeth chestnut colored at tips, and tail about one quarter the length of the head and body. It depends on the highly specialized senses of touch, hearing and smell for guidance in probing about and searching for food, the eyes being very slightly developed.

General works on natural history speak of the diet of shrews as being chiefly worms, larvæ of insects and small mollusks.

Audubon and Bachman,[2] in speaking of the Carolina shrew (*Blarina brevicauda carolinensis*), an animal somewhat smaller than the short-tailed shrew, say:

> In digging ditches and ploughing in moderately high grounds, small holes are frequently seen running in all directions, in a line nearly parallel with the surface, and extending to a great distance, evidently made by this species. We observed on the sides of one of these galleries a small cavity containing a hoard of coleopterous insects, principally composed of a rare species (*Scarabœus tityns*) fully the size of the animal itself; some of them were nearly consumed, and the rest mutilated, although still living.

Merriam[3] says that "it subsists upon beechnuts, insects, earthworms, slugs, sow-bugs and mice." He also speaks of its feeding on chrysoledes and the larvæ of insects. He quotes Mr. John Morden, in the *Canadian Sportsman and Naturalist,* Vol. III., 1883, in which the latter describes the mouse-killing and eating propensities of the short-tailed shrew and draws these conclusions:

> According to my observations, the little mammal under consideration eats about twice or three times its own weight of food every twenty-four hours, and when we consider that their principal food consists of insects, it is quite bewildering to imagine the myriads one must destroy in a year.

Merriam proceeds to tell of an encounter between a short-tailed shrew weighing 11.20 grams and a deer mouse (*Peromyscus leucopus*) weighing 17 grams, in which the former was victorious, and after eating an ear, the brains, side of the head and part of the shoulder of the mouse, weighed 12 grams. He says:

[1] U. S. Dept. Agriculture, North American Fauna Series No. 10, p. 4, 1895. "Revision of the Shrews of the American Genera *Blarina* and *Notiosorex,*" by C. Hart Merriam.

[2] Audubon and Bachman, "The Quadrupeds of North America," 1849.

[3] Merriam, "The Mammals of the Adirondack Region," 1884.

If left without food for a few hours he will eat corn from the cob, beginning at the outside of the kernel, but it is very clear that he does not relish his fare. He will also eat Indian meal and oats when other food is not at hand. Slugs and earthworms he devours with avidity, always starting at one end, and manipulating them with his fore paws. But of the various kinds of food placed before him, he shows an unmistakable preference for mice—either dead or alive.

Rhoads[4] writes:

It is known that they (*Blarina brevicauda*) subsist to some extent on vegetable food, chiefly nuts, but they do only indirect damage to agriculture by disturbing the roots of plants.

He also states that they eat "salamanders, other batrachians, and reptiles which haunt their burrows."

Shull[5] found that this shrew eats house mice, May beetles (*Lachnosterna*) and their grubs, moth larvæ, other insects and pupæ, earthworms, snails of the genus *Polygyra*, sow-bugs and beef. "Carrots, crackers, roots of grasses and other plants," he says, were never touched as food.

Stone and Cram[6] relate the following observation:

One that I caught in a trap had already, when I found it, disposed of the raw meat which had served as bait, and when confined in a cage immediately seized upon whatever meat was offered it, whether raw or cooked, without discriminating between kinds. Beef, pork and cold chicken—all went the same way, while the fury of his appetite was being appeased.

They also write:

I believe that they get the greater part of their food at this season (winter) by burrowing about among the dead leaves beneath the snow in the forests, gathering the dormant insects that habitually pass the winter in such places.

Seton[7] states that the diet of the short-tailed shrew is chiefly insects and worms, but that it will eat "any kind of living food it can find and master, preying largely, . . . on field mice, which equal or exceed it in weight." He believes dormant insects form a large part of its sustenance in winter. He gives the following list of stomach contents findings from short-tailed shrews, taken at Cos Cob, Connecticut:

No. 1. Earthworms, almost whole; membranous wings of beetle.
No. 2. Connective tissue, cartilage and muscle.
No. 3. Earthworm setæ, parts of insects; some of its own hair, probably swallowed with food.
No. 4. Earthworms.
No. 5. Earthworm setæ.
No. 6. Insects.
No. 7. Insects.
No. 8. Legs of Isopod.
No. 9. Muscles and setæ of earthworms.
No. 10. Earthworms.
No. 11. Earthworms and insects.
No. 12. Isopod legs and insects.
No. 13. Earthworms, insects, connective tissue and striated muscle, probably of some small rodent.

Shull reports the findings of two stomach contents as follows:

1. An insect larva.
2. Meadow vole.

In speaking of the short-tailed shrew, Corey[8] quotes Dr. John T. Plummer[9] as follows:

It was given flesh of all kinds, fish, coleopterous as well as other insects, corn, oats and other kinds of grain, all of which appeared to be acceptable food. "The corcle of the grains of maize was always eaten out, as it is by rats and mice." When water was put into the box the shrew "wet his tongue two or three times and went away; but when worms were dropped into the cup, he returned, waded about in the water, snatched up his victim, maimed it, stored it away, and returned repeatedly for more till all were secured." A full-grown living mouse was put into the box, which was at once fiercely pursued by the shrew, attacked and killed. Another mouse met with the same fate.

This habit of attacking mice is well known among those who have studied into the matter. Merriam and Morden have vividly described

[4] Rhoads, "The Mammals of Pennsylvania and New Jersey," 1903.

[5] Shull, "Habits of the Short-tailed Shrew, *Blarina Brevicauda* Say," *American Naturalist*, Vol. XLI., No. 488, pp. 496–522, August, 1907.

[6] Stone and Cram, "American Animals," 1905.

[7] Seton, "Life Histories of Northern Animals," 1909.

[8] Corey, "The Mammals of Illinois and Wisconsin," Publication 153, Zool. Ser., Vol. VI., Field Museum of Natural History, Chicago, Ill., 1912.

[9] *Am. Jour. of Sci.*, Vol. XLVI., 1884.

such encounters, but Kennicott[10] is the only writer who has described an encounter in which the shrew was attacked by the mouse. He says: "When attacked by a meadow mouse (*Arvicola scalopsoides*), etc. . . ." Shull states, in speaking of short-tailed shrews kept in confinement, that house mice were captured when they entered the shrews' burrows, while voles were pursued and cornered above ground, and that most of the killing was done at night.

While the observations referred to above were regarding house mice (*Mus musculus*), meadow mice (*Microtus pennsylvanicus*) and white-footed or deer mice (*Peromyscus leucopus*), the writer found that red-backed mice (*Evotomys gapperi*) were no exception, for on two occasions a short-tailed shrew which the writer had under observation, overcame and killed a red-back without apparent injury to itself. Morden states that it took about ten minutes for a short-tailed shrew to overcome and kill a meadow mouse larger than itself, and Merriam found his 11.2 gram shrew was half an hour in tiring and half an hour in killing a 17-gram deer mouse. In the encounter witnessed by the writer, it required twelve minutes for the shrew to kill the mouse after getting its first hold. On another occasion the shrew, which weighed 15 grams, captured and killed during the night a red-backed mouse, weighing 29 grams and seemed uninjured after the encounter.

It is difficult to conceive how a shrew, with its very limited vision (the eyes being probably of service only in distinguishing light from darkness) can capture an uninjured mouse in the freedom of the woods (the box in which the shrew and mice were confined was 18 in. $\times$ 20 in.) yet this shrew had a systematic method of attack, and always opened the skull of its victim in the same general location, which would seem to indicate that it had had experience in such encounters, or else had acquired the knowledge by heredity, which would also indicate a long series of such battles by its ancestors. An exception to its habitual method of opening the skull was observed one day when an adult Norway rat (*Epimys norvegicus*) freshly killed, was placed in the box. Instead of entering the cranial cavity between the eye and ear, as usual, it opened the throat and worked into the brain through the base of the skull.

An interesting habit which this shrew exhibited, and which may illustrate one method of capturing mice under natural conditions, was noted as follows: Whenever a live mouse was placed in the box with the shrew, the latter at once secreted itself under some small pile of leaves or moss. In the course of a few minutes the mouse, while exploring its new quarters, would jump on the pile under which the shrew was concealed, whereupon the shrew would spring up and try to get hold of the mouse. This was attempted on several occasions, always, however, without success.

Animal food in any form seemed acceptable, while only a limited variety of vegetable matter was eaten. It ate grasshoppers (*Melanoplus femoratus*) and crickets (*Gryllus* Penn.) with avidity; raw beef sparingly, preferring the fat; and small amounts of American cheese. One morning when no other food was at hand, it devoured the abdominal contents of another shrew of the same species, freshly killed. As soon as other food was placed in the box, however, the remains of the dead shrew were at once and permanently deserted, which would indicate that this animal did not become cannibalistic except under stress of circumstances. In speaking of this habit it may be of interest to quote Merriam's observations on the long-tailed shrew (*Sorex personatus*), a much smaller animal. He writes,

> I once confined three of them under an ordinary tumbler. Almost immediately they commenced fighting, and in a few minutes one was slaughtered and eaten by the other two. Before night one of these killed and ate its only surviving companion, and its abdomen was much distended by the meal. Hence, in less than eight hours one of these tiny wild beasts had attacked, overcome and ravenously consumed two of its own species, each as large and heavy as itself!

Another shrew under observation devoured

[10] Kennicott, Report of the Commissioner of Patents for 1857. Agriculture, "The Quadrupeds of Illinois Injurious and Beneficial to the Farmer."

a small garden toad, but allowed a large one (40 grams est.) to remain in the box for five hours unmolested, at the end of which time the toad was removed.

Professor Cope[11] writes of a Carolina shrew overcoming a water snake (*Tropidonotus sipedon*) two feet in length, in a night, which shows the courage and fighting qualities of this little beast.

To test the keenness of the senses of this shrew, a skin of a meadow jumping mouse (*Zapus hudsonius*), dried some months previously, was placed in the box. It was at once furiously attacked, but was removed as soon as torn about the head, because of the presence of white arsenic inside. So vigorous was the attack that the mouse skin was repeatedly lifted from the floor with the shrew still clinging on, biting and tearing. It would have been interesting to see how long the ill-directed attack would have been continued.

Moles and shrews have been often accused, by farmers especially, of being agents of destruction about gardens and of subsisting on the vegetable food found there. In all probability the only damage committed, by this species of shrew at least, is done indirectly, as referred to above, by disturbing roots while burrowing about for insects or worms. The following experiment, which bears on this matter, was carried out with the same results on two different occasions. The box being cleared of all food, the following twenty-one varieties of common vegetable matter, most of it freshly gathered, were put in: cabbage, cauliflower, lettuce, potato, carrot, parsnip, string-bean, pole-bean, summer squash, turnip, beet, sweet corn, rhubarb, kohlrabi, tomato, cucumber, peach, pear, canteloupe, banana and olive. At the end of nine hours (first experiment), the shrew was found curled up in one corner of the box, weak and listless, while not one of the vegetables had been touched, with the exception of the olive, which had been nibbled. (This may have been eaten to get the salt, as the olive had been kept in brine.)

[11] Cope, "On a Habit of a Species of *Blarina*," *Am. Nat.*, Vol. VII., No. 8, pp. 490–491, Aug., 1873.

When the experiment was tried the second time, the shrew remained eleven hours without food, and showed quite a marked constriction about his abdomen at the end of that time. These results seem to vindicate the short-tailed shrew from the charge of being a garden thief.

An exception to its non-vegetarian habits, however, was found to be made in regard to rolled oats. These it ate at first sparingly and with little relish, but later lived on them exclusively for fifty-two hours and at the end of that time seemed as vigorous and contented as ever. Seton speaks of taking a female short-tailed shrew whose stomach was full of corn meal unmixed, and owing to the unusually slow process of putrefaction in the animal, he reasons that it had been on that diet for some time. Merriam writes of one he had in confinement that was "very fond of beechnuts and thrived when fed exclusively on them for more than a week." Judging from these findings, dry vegetable food seems to be preferred to succulent varieties.

The writer's shrews did not exhibit the ravenous appetite attributed to the species by some observers. They did not pursue their prey persistently, and having captured it, seemed satisfied, for the time being, with a small amount of food. Shull gives two thirds of a meadow vole or one house mouse as the average daily diet. This is a higher average than that made by the shrews under observation, as two thirds of a house mouse, or its equivalent, was amply sufficient. They drank small quantities of water frequently. However, within the twelve hours immediately following an eleven-hour fast, one ate 16 grams of animal food (more than the equivalent of its own weight—15 grams), which fact demonstrates their latent capabilities in that direction. Quoting Seton again, he says:

> Numerous experiments and observations on captive animals prove that the *Blarina*, like its smaller kin, has an enormous appetite which must be satisfied, or in a very few hours the creature succumbs.

The writer found an uninjured shrew of this species, dead in a cage trap seventeen hours after setting it, showing that death by starva-

tion took place in something less than that time.

The favorite diet of the animals under observation was, without question, freshly killed mice. Shull, estimating four of these shrews to the acre, figured that on a farm of one hundred acres, they would, in a year, devour 38,400. Realizing the vast amount of damage these rodents are capable of producing in agriculture and considering also the almost exclusively carnivorous habits of the *Blarina brevicauda,* one must admit a great economic value for this shrew.

H. L. Babcock

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The Limit of Uniformity in the Grading of College Students by Different Teachers[1]

In the University of Missouri our grades have, since five years ago, been defined by the frequencies of their permitted occurrence: according to our definitions 25 per cent. are superior, 50 per cent. medium and 25 per cent. inferior grades.[2] We hoped thereby to diminish or even exterminate the divergence of marking then existing. We actually reduced this divergence; but only two thirds. We failed to exterminate it. One third of the former lack of uniformity persists, as may be seen from my previous report in Science, and we ask the question: Why does it persist?

It seems that the chief cause is the inability (call it unwillingness, if you wish, but nothing is gained by any name) of the teachers to differentiate between the performances justly to be expected of a freshman and a senior. For simplicity's sake I speak of two college classes only. Instead of recognizing the relatively superior work of certain freshmen among the freshmen, the teacher compares their work with the work of seniors, and then, of course, finds it to be but weak. And, instead of recognizing that some of the seniors are much less accomplished than other seniors, the teacher compares the weaker senior's accomplishment with that of the freshman and finds it quite remarkable. The result is a widely spread tendency of teachers to report an excess of inferior grades in freshman classes and an excess of superior grades in senior classes. This seems to explain that persistent fraction of the lack of uniformity which we could not eradicate.

Here is the example of an individual teacher in history whose total distribution of grades is approximately that prescribed by the university:

	25% Sup.		50% M.	25% Inf.	
	%E	%S	%M	%I	%F
Underclassmen	1	16	51	25	7
Upperclassmen	6	30	40	20	4

Is there any remedy? It seems simple. Let the teacher differentiate more between the work of freshmen and that of seniors. Assign to the freshman such tasks as are appropriate to the condition of the student who has just left the high school, and to the senior tasks which approach in difficulty, in the requirement of initiative, of resourcefulness, the tasks which the research work of the graduate school keeps ready for the senior as soon as he has his diploma.

But this remedy is not as simple and easy of application as it looks, for the average college teacher seems to be incapable of making the differentiation required. Instead of comparing, rather, freshmen with high-school pupils and seniors with graduate students, he compares freshmen with seniors in the performance of an identical task given to both. However, we must have patience with the teacher. His own task is not small. There are three influences from which he can not easily free himself. (1) Freshmen and seniors, after all, belong socially to one group, that of college students, and neither to the group of high school pupils nor to that of members of the graduate school. (2) He is in mental contact with both freshmen and seniors all the time, but usually no longer with high school pupils and not, probably, with graduate

[1] Read before Section L—Education—American Association for the Advancement of Science, Atlanta, December, 1913.

[2] Compare two former papers: "The Grading of Students," Science, 28, pp. 243–250, 1908; "Experiences with the Grading System of the University of Missouri," Science, 33, pp. 661–667, 1911.

students either. (3) He probably has, frequently, in the same class both freshmen and seniors taking together exactly the same course, and then he can hardly be blamed for comparing their work, even though in the abstract he ought not to compare it. If we want to solve the problem, we have to free the teacher who, usually, is incapable of freeing himself, from these three influences. And that looks like an almost hopeless problem. But, meanwhile, let us not forget that two thirds of the lack of uniformity in grading among teachers can be removed, and that this can be done easily and simply by proper definitions of the grades, for example, by those definitions which we have used in Missouri.

I have now practically said what I wanted to say. If I continue, it is for the illustration of special points rather than for the statement of any additional principle. Let me recall the remark that the tasks to be assigned to seniors, or to members of both upper classes, ought to approach in the requirement of initiative, of resourcefulness, of originality the tasks which the research work of the graduate school places upon its students. I here wish to make it clear that the average college teacher may be expected to offer stubborn resistance to such a demand. For the illustration of the fact that the work assigned to upper classmen generally approaches, in the lack of any requirement of resourcefulness, the work of the high school rather than that of the graduate school, let me refer to data which, at the first glance, seem to be unrelated to the question, but which nevertheless illustrate it well. I am thinking of the high marks obtained by the women students in coeducational institutions. In the University of Missouri we find for the first semester 1912/13 the following record:

Grade Hours		Per Cent. Superior	Per Cent. Medium	Per Cent. Inferior
22,000	Men	23	53	24
7,000	Women	29	55	16

I suppose that the purpose of college training is to prepare students to meet more proficiently all the varied demands which society later will make upon them,—as the common phrase is, to make better men and better women of them. According to the college records one should expect that women rather than men would be found to be the leaders of human society. As a matter of fact there are but few women among the leaders of mankind even in this decade of this century. I recognize, of course, that women are handicapped by three conditions, by legal discriminations, by the force of tradition, and especially by the obstacles resulting from motherhood. No one, however, would assert that, these obstacles being removed, the women would surpass the men in the leadership of society. There is, then, something wrong in such college records which bluntly state that college women are better prepared for leadership in human life than college men. What is wrong in these records is obviously the result of the teachers giving the wrong kind of a test. Instead of testing the initiative which the student should have been trained to put into action for the solution of a certain kind of problems, the teacher tests almost exclusively that kind of accomplishment which depends on the degree of faithfulness and regularity in the performance of assigned tasks. We need not be astonished that the average teacher does not and really can not give the former kind of test, the test of "initiative put into action." Educational science is still so undeveloped that in many subjects the teacher himself does not know how to give such a test. And then—he who tests initiative has to employ initiative himself in the act of testing. That requires an immensely greater effort on the part of the teacher than to test, in the traditional way, how faithfully the students have done their assigned work, and so we can hardly expect the teacher, already overworked, to put himself under the strain resulting from a more proper method of testing.

The same conditions apply to the testing of freshmen and seniors. The seniors, being only one step removed from graduate students, ought to possess a comparative degree of initiative. But their examinations are conceived more like those of college freshmen

than like those of beginners in graduate work. The teacher thus develops in himself the illusion that his average senior, however illogical this is, stands above the average of his own group, and that all the seniors deserve unusually high marks, that is, in comparison with freshmen. But let these seniors enter the graduate school, and some of them will be found, by the different kind of test there employed, to be almost incapable of doing any graduate work at all, because they are deficient in originality, initiative, resourcefulness, whatever you call it, in their chosen line.

This tendency to compare freshmen and seniors is so deep-seated that there is no hope of eradicating it by simply calling attention to it. As in college, so you find it in the high school. My former colleague in Missouri, Professor C. Alexander, found in an (unpublished) investigation of the grading of high schools, that the freshmen are reported partly as average scholars, partly as superior, and partly as inferior; but the seniors, there, too, are reported mostly as high-grade scholars. The low-grade scholars are said to have been eliminated. Now some of these high-grade scholars, obviously not the worst, enter the state university. One should think, then, that our college teachers in the freshmen classes would find it a difficult task to separate from this whipping cream any more plain milk. But the contrary is true. Our teachers complain constantly of the poor scholarship of these "selected" college freshmen.

All this shows, by the way, how unfounded the statement is which we hear again and again that the normal, *i. e.*, symmetrical, curve of distribution is inapplicable to college students because they are supposed to be a selected group. Only then would the symmetrical curve of distribution be inapplicable, if the college freshmen under consideration had been selected by freshmen tests from college freshmen, or if the college seniors had been selected, by tests appropriate to seniors, from the entire group of seniors. There is no reason why the symmetrical curve should be inapplicable to the entire group of freshmen, or to the entire group of graduate students or to any group, provided only that the group is complete as a group. That the group came into existence by selection from a different group does not seem to matter when each new group is confronted with new kinds of tasks. There are those who say that it is easy to prove, by examination tests of the ordinary, traditional type, that college students must be regarded as a selected class[3] in the sense that their distribution is not represented by a symmetrical, but by a skewed curve. I have already, a few years ago, called attention to the fact[4] that such examinations are unreliable. Simply make the examination difficult and set a time limit; the curve appears skewed one way, most of those tested crowding in the direction of low ability. Make the examination easy and abolish or greatly extend the time limit; the curve appears skewed the other way. I offer to prove at will by an examination left to my choice that any group of students is distributed either way. Just tell me in advance which way you want the curve skewed.

For the practical problems of college administration this question as to the exact nature of the curve of distribution is really of minor importance. If, however, we just have to make an assumption, it is safest to assume the symmetrical normal distribution. We have assumed in Missouri that the distribution is either normal or very nearly so and experienced no inconvenience. We have reduced the lack of uniformity between teachers to one third of its former amount simply by the adoption of scientifically justifiable definitions, and a reduction to that amount is worth while. But to eradicate the last third is a complex problem of the future, so complex that it may never be completely solved. As has been indicated, it seems to involve problems of our whole educational system and even of the broader social organization of the nation.

Max Meyer

[3] Compare the two tendencies, conflicting with each other, according to Cattell, *Popular Science Monthly*, 1905, p. 372.

[4] Science, 33, p. 667, 1911.